FLIGHT and The AIRCRAFT ENGINEER

First Aeronautical Weekly in the World : Founded 1909

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Editorial, Advertising and Publishing Offices: DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1
Telegrams: Truditur, Sedist, London. Telephone: Waterloo 3333 (35 lines).

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8-10, CORPORATION ST.,	GUILDHALL BUILDINGS, NAVIGATION ST.	260, DEANSGATE,	26B, RENFIELD ST.,
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Telephone: Coventry 5210.	Telephone: Midland 2971 (5 lines).	Telephone: Blackfriars 4412.	Telephone: Central 4857.

SUBSCRIPTION RATES: Home and Abroad: Year, £3 1 0. 6 months, £1 10 6. 3 months, 15s. 3d.
Registered at the G.P.O. as a Newspaper.

No. 1739. Vol. XLI. APRIL 23rd, 1942. Thursdays, One Shilling.

The Outlook

The Three Services

THAT general uneasiness exists in the country about the relations of the three fighting Services was shown once again by a debate in the House of Lords on April 15th. In the course of that debate, Lord Trenchard, sticking to his cardinal principle that no warlike aircraft ought to be in the possession of any body except the Royal Air Force, remarked that the first essential of an airman was to be an airman. That is a truism which nobody is likely to dispute. In the same way it could be said of horsed cavalry that the first essential of a trooper was to be a horseman, yet a mere collection of some 400 horsemen did not make a cavalry regiment.

One may carry the illustration further and cite the case of the tactical reconnaissance squadrons which work with the Army. The observing is done by the officer who flies the machine. His flying is considered to be entirely a matter of course, performed almost subconsciously, while his attention is concentrated wholly on what he sees below and on the reports which he makes. That man, in 50 per cent. of the total cases, is an Army officer who has been taught to fly. In the Navy, too, there are many executive officers who are first-rate pilots. Therefore, if Lord Trenchard intended his words to mean that an airman ought, if he is to be of any use, to be a member of the Royal Air Force, as it seems that he did, his contention cannot be passed as valid. The mere ability to fly is like the tools of a carpenter with which something useful can be made. It is the task, not the element, which should decide the proper place for a fighting man.

The Government Reply

LORD SHERWOOD, Joint Under-Secretary for Air, who replied for the Government, was once, as Sir Hugh Seely, the C.O. of a squadron of the Auxiliary Air Force, and he naturally took the conventional Air Ministry view. His arguments, however, were not very convincing. He pointed out that the *Luftwaffe* contained neither a naval nor an army air arm. It is quite natural that the Germans should not have bothered much about a naval air arm or a Coastal Command, but as for their army, practically the whole of the *Luftwaffe* (however commanded) has worked as the air arm of the German land forces. In any case, the German plan is not necessarily the final word. Lord Sherwood also seemed to be demolishing arguments which have not been put forward by responsible critics of the present system. He said that it had always been accepted that there must be a limited number of specialised aircraft for work with the Navy and the Army, but the main striking force must remain with the central Air Force.

That is what *Flight* has always maintained. The central Air Force must be flexible and prepared to help either of the other Services when necessary. But to hold that view does not mean that the squadrons of specialised aircraft must also be part of the R.A.F. Operational control is a very unsatisfactory way of using fighting men, except for temporary occasions. They are in a much better position if they are raised, paid and equipped by the Service for which they do their normal work. As examples of how to do things properly we would quote the Royal Marines, the R.A.F. armoured

cars, and the Fleet Air Arm. The deplorable effect sometimes produced by operational control was exemplified by the state of A.A. equipment in the Territorial Army at the time of the Munich crisis.

A Combined General Staff

THE debate in the Lords showed many peers of experience in favour of a Combined General Staff to plan a campaign with full consideration of the part to be played by each of the three Services. There are plenty of signs that we British, and not only we but all the United Nations, are working steadily in that direction. We have a leader of Commandoes who controls the elements of all three Services which take part in a raid, and we have now reached the point of giving Admiral Lord Louis Mountbatten honorary high rank in the Army and Air Force, so that his right to give orders shall be made clear to all three. In the Western Pacific General Wavell was first given command over all the Services of all the United Nations, and, though the areas have been altered, his successors have been given similar powers. In Ceylon we have an Admiral as Commander-in-Chief of all three Services; and so the movement spreads.

It is rather quaint to note that Vichy is following our example, for Admiral Darlan has been made Commander-in-Chief of all three French Services—though only the remains of the French fleet is now of any serious consequence.

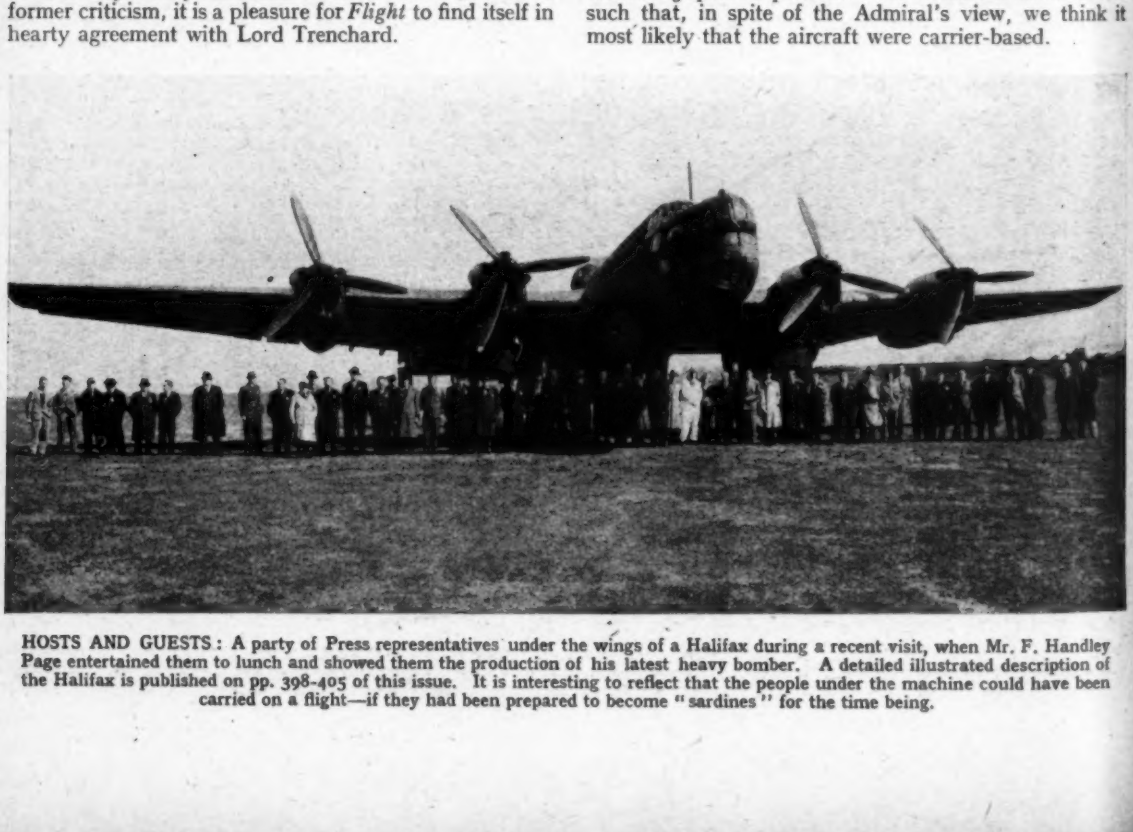
It seems obvious that we must come to a Combined General Staff in this country before long. The feeling is spreading that neither the Committee of Imperial Defence nor the Chiefs-of-Staff Committee is meeting the need. Some previous Chief of a Staff once said that the Committee seldom disagreed because they so often agreed to differ. We want something better than that. Lord Trenchard said in the Lords debate last week that there must be at the top some form of combined staff for the day-to-day direction of the war. In view of former criticism, it is a pleasure for *Flight* to find itself in hearty agreement with Lord Trenchard.

Augsburg and Tokyo

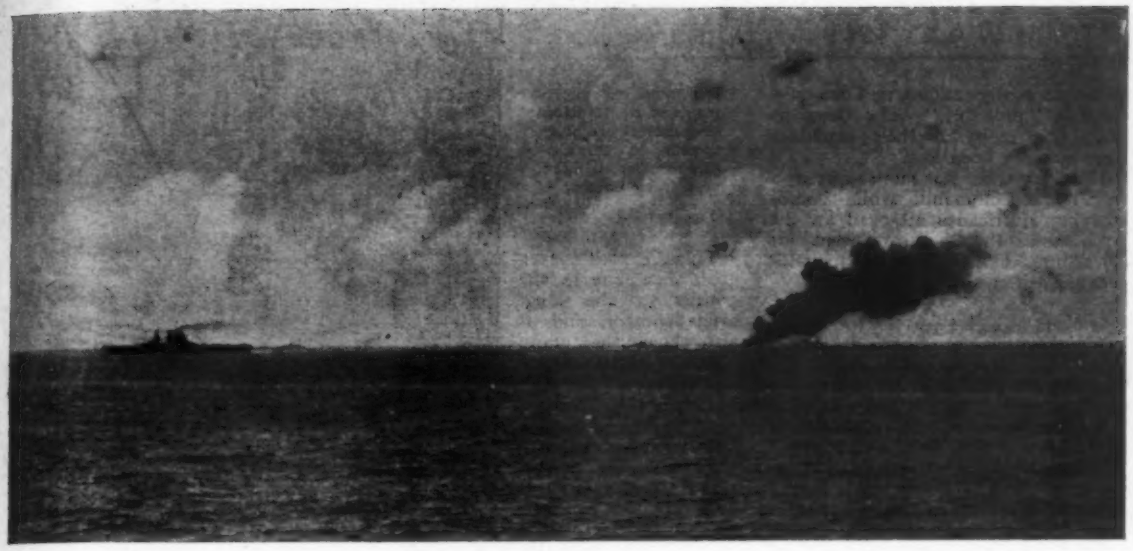
AT the two ends of the far-flung battle line the United Nations have struck blows at the Axis which take away one's breath with their audacity, and must have had an even more stunning effect on Germany and Japan. In each case the weapon used was the long-range bomber, and in each case the benefit to the Allied cause may well be far-reaching.

In the history of air warfare, short as it is, there has never been anything like the daylight flight of the Lancasters at a height of 30 feet over 500 miles of enemy territory and back. Though the R.A.F. lost seven out of the twelve bombers, and some 50 of our airmen (some dead, some prisoners) can no longer serve their country in this war, the destruction of the factory for U-boat engines may well save hundreds of British and Allied lives on the Atlantic and bring to our shores weapons which will enable us to save still more lives. The Prime Minister, in sending a message of thanks to the crews, well said that in this memorable feat of arms no life was lost in vain.

The bombing of Tokyo and three other industrial cities in Japan by the Americans was also a splendid feat, and was equally unexpected by the enemy. Japanese war industry is concentrated in only five towns, four of which were raided. No doubt Washington will disclose in due course (perhaps before these words are read) where the bombers came from. The first idea was from a U.S. carrier, but an American Admiral has expressed the opinion that they came from Alaska, via Attu in the Aleutian islands. Other possibilities are that the base was Australia, using a secret refuelling place on one of the islands, as Brig.-Gen. Royce did on his visit to Manila; or that the bombers flew from India to the most advanced base which was practicable in China, and then on to Japan. If they came from Alaska they may not have returned to their starting point. The Americans may have been delivering bombers to China, and have bombed Japan *en passant*. The distances involved are such that, in spite of the Admiral's view, we think it most likely that the aircraft were carrier-based.



HOSTS AND GUESTS: A party of Press representatives under the wings of a Halifax during a recent visit, when Mr. F. Handley Page entertained them to lunch and showed them the production of his latest heavy bomber. A detailed illustrated description of the Halifax is published on pp. 398-405 of this issue. It is interesting to reflect that the people under the machine could have been carried on a flight—if they had been prepared to become "sardines" for the time being.



A Japanese bomber in flames on the sea after attacking the U.S. aircraft carrier on the left of the photograph.

War in the Air

The George Cross for Malta : North Italy Bombed Again : Great American Air Raid from Australia to Philippines and Back

THE island of Malta continues to be the hero of the hour, and it is pleasing to hear that it has recently received a visit from Sir Walter Monckton, acting Minister of State in the Middle East, and Air Marshal Sir Arthur Tedder, A.O.C.-in-C., Middle East, whose Command includes Malta, although it has its own A.O.C. in Air Vice-Marshal Lloyd. The visit pleased both the islanders and the R.A.F., and Sir Walter made an interesting broadcast about what he saw. He quoted the remark of a German pilot prisoner, who said, "The only way to get Malta down is to sink it." Curiously enough, a recent German propaganda statement to the German people, in trying to explain the Axis failure there, said, "You cannot expect German bombs to sink the island." It seems that German aircraft attack the place by day, but the Italians are allowed to go over at night. The latter is doubtless a less dangerous time, but even so it is said that when they meet the defences, A.A. and night fighters, the Italians are very ready to turn back to Sicily. H.M. the King has awarded the George Cross to the island as a whole.

From the end of September last year until the middle of April, Northern Italy has had rest from the attentions of the home-based R.A.F., and the people had got slack about their blackout. So when some Whitleys crossed the Alps last week and found the triangle Turin-Milan-Genoa largely hidden by clouds, the navigators were very grateful for the lights which were showing in some houses even as late as 2 a.m. When the first bombs dropped the lights were put out in a hurry, and the night life of the place was rudely interrupted. The official bulletins did not say much about the estimated results, but we may hazard the guess that the port of Genoa came in for special attention.

Recently there has also been a succession of heavy raids on the Ruhr, while the days of bright sunshine have seen some very spirited fighter sweeps over northern France. King Haakon of Norway visited a fighter station one day just before the squadrons took off, talked to the pilots, and then went into the operations room to watch the raid being directed. A squadron of Bostons was sent to attack targets near Caen in Normandy, and several squadrons of Spitfires were sent as escort. But actually Spitfires were over France from 10 a.m. to 7.30 p.m. that day, and they fought with Me 109s and FW 190s. If we knew all that the Germans know about their own casualties that day, we should doubtless be very pleased, but pilots in dog fights are often too busy to see whether an enemy whom they have

General Sir Archibald Wavell arriving at a R.A.F. airfield in Burma. He was met by General T. J. Hutton who is seen on the left.

WAR IN THE AIR

shot up actually crashes, and can only claim a "probable." The Germans know how many of their machines have actually been lost.

Next day there was more aggression by Fighter Command, while bomb-carrying Hurricanes attacked an air base, and other bombers went for Cherbourg. Our fighters gave magnificent protection to the bombers.

Bravo America!

BRIGADIER-GENERAL R. ROYCE was recently U.S. air attaché in London, and made himself very popular. His friends in this country were therefore very pleased to learn that President Roosevelt has awarded him the American Distinguished Flying Cross for leading a magnificent bombing raid from Australia to the Philippines and back. He led a force of three Fortresses and ten twin-engined Martin B25s, and only lost one of them, which was damaged on the ground while an engine was being changed. The crew were brought back to Australia, as well as 34 other passengers from the Philippines, including Captain Jesus Villamor, of the Philippine Air Corps, who has been awarded the American D.S.C. with oak leaves for outstandingly gallant work in the defence.

The bombers established a base at a secret airfield which was protected by fighters, and they spent a night there. The fighters shot down two Japanese machines which attempted to attack the bombers. The appearance of the bombers came as a surprise to the Japanese, and General Royce said that they threw the enemy into a panic.

The bombers had timed one raid on Davao to synchronise with an attack by American and Philippino forces in that area. They also bombed objectives of various descriptions in several of the islands, and their activities naturally included attacks on enemy shipping in some of the harbours. Altogether 110 tons of bombs were dropped, and it is to be hoped that substantial damage was done.

The latest air photograph of the Matford lorry factory at Poissy, showing a considerable number of direct hits by bombs.

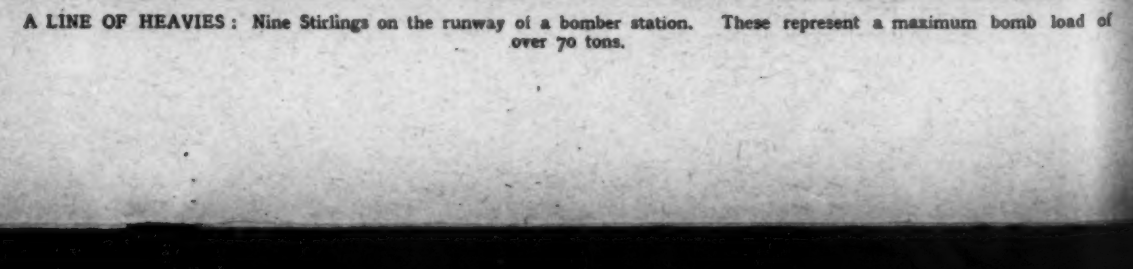
This exploit is a great testimony to the powers of the long-range bomber, and it also shows the grand offensive spirit of the American airmen. Hitherto the initiative in the Pacific campaign has lain mostly with the Japanese, and it was a very good thing to treat them to a surprise of this sort. There are other surprises coming to them in due course.

Another example of initiative, and likewise of the good use which can be made of bombers, has been the unremitting offensive which the Royal Australian Air Force, with American help, has kept up on the bases which the Japanese have seized at Rabaul, at Lae in New Guinea, and at Kupang in Timor. To all appearance these raids have definitely held up the Japanese and prevented them from developing attacks on Australia from these island bases. Of course, it may be that Japanese strategy is now more concerned with the invasion of Burma and the double object of cutting off China from her main source of supplies and also advancing on India to stretch out a hand towards the German thrust through the Caucasus, if that should develop. They may intend merely to keep Australia on tenter-hooks, and tie up there land and air forces which have been called back from the Middle East, and which could now be very useful there. Certainly the air raids on Darwin and other Australian coast towns do not seem to have been launched with very serious intentions, and they have done little damage. On the other hand, if the Japanese could invade Australia and capture Sydney, they would deprive the United Nations of the best naval base now remaining to them from which to start the great sea offensive against Nippon when the right time comes. The Japanese have accomplished very much in the time during which the United Nations have lost command of the sea, but even they cannot do everything at once.

In the Indian Ocean

THE Prime Minister has made known some facts about the attacks on Ceylon. The Japanese had sent a strong naval force there, including battleships, whereas we had only cruisers and (so far as is known) one ancient carrier which could only send up about 15 aircraft. From the island, however, torpedo-aircraft flew out to attack the enemy fleet, but were beaten by the weather. All of our machines were either shot down or damaged, but numbers of them regained their bases and have been made serviceable once more.

Port Blair in the Andamans has become a menace, a naval and air base for the Japanese. But the R.A.F. has raided its harbour very effectively.



A LINE OF HEAVIES: Nine Stirlings on the runway of a bomber station. These represent a maximum bomb load of over 70 tons.

WAR IN THE AIR

OLD FAITHFUL : An A.W. Whitley which, according to the bombs painted on the nose, has completed three dozen raids over enemy territory. There are others to be added when the squadron artist has time.

Last week-end two sensational feats by Allied aircraft stirred popular exultation throughout the united nations. On April 18th, at 12.30 p.m., a strong force of American bombers, numbering 60 according to a broadcast from Tokyo, appeared out of the blue (presumably from a U.S. carrier) and proceeded to bomb the capital of Nippon and the neighbouring port of Yokohama. Both cities are full of factories, surrounded by slums of flimsy wood and bamboo residences which would burn like matchwood. Then the Americans went on to Nagoya and Kobe and dropped more bombs there. All these four places are centres of Japan's war industry, and Osaka is the only other place of much importance in that respect. Japan has for a considerable time past been unable to import much of the raw material which she needs to keep her armies in the field and her fleet at sea, though she may have been able to pile up reserves before she entered the war. Even in that respect her efforts must have been limited, for she has been fighting in China for four years and has had to maintain large land and air forces there. In contrast to Germany, Nippon offers a concentrated target for useful bombing.

BRITISH AIR LOSSES TO APRIL 18th.

	Over G.B.	Over Continent		Middle East
	A'crft.	B'brs.	Ftrs.	A'crft.
April 12	0	11	14	0
,, 13	0	0	0	0
,, 14	0	11	4	1
,, 15	0	4	3	7
,, 16	0	2	2	0
,, 17	0	17	1	0
,, 18	0	0	0	1
	0	45	24	9 (5 pilots safe)

Totals : North, 3,523 ; Middle East, about 1,079 ; Far East (unofficial), 48.

How the *moral* of the Japanese people will stand up to ordeals of this sort, which may be repeated any number of times, remains to be seen. It also is uncertain whether the war lords will need to pay much attention to popular feeling if the will to resist breaks down under such a strain. Hitherto the Japanese people have had no cause to look on war as anything near to their own lives, except in so far as families have lost relatives in the armies, and that living has been made harder by the high taxation. They are essentially a warlike people, and have seemed able to bear any losses and privation so long as news of victory came in with consistent regularity. Now war has been brought into their homeland.

It is notable that a former Ambassador in London has tried to put the Japanese people on their mettle by telling them how the British had endured deluges of bombs for more than two full years, and that if the Japanese lost their composure the Americans and British would laugh at them.

The Lancaster Makes Its Bow

JUST occasionally the name of the Lancaster bomber has been heard by the British public, and it has been known that it is a four-engine development of the Avro Manchester. It has now made a positively startling entry into the war news. On April 17th twelve of these monsters in three sections, led by Sqn. Ldr. J. S. Sherwood, D.F.C., Sqn. Ldr. J. D. Nettleton, Flt. Lt. D. J. Penman, D.F.C., and Flt. Lt. R. R. Sandford, flew right across Germany in daylight at a height of 25 to 30 feet, to Augsburg, 500 miles away, bombed it, and flew back. The point of keeping low is that fighters cannot get underneath, while many A.A. gun crews cannot get their sights on to the bombers in the brief moments while they are within the gunners' range of vision. South of Paris, German fighters attacked for fifteen minutes and shot down four of the Lancasters, not without loss to themselves. Then our raiders were not worried until they reached the target, where they identified the buildings in which diesel engines are made and dropped their bombs with accuracy. After the attack three more of the Lancasters were brought down by *flak*, but one at least was seen to make a perfect forced landing although it was on fire. The remaining five reached home safely.

It was an amazingly audacious feat to fly so far in daylight, but the blow to the diesel engine factory may hold up many U-boats, make a real difference to the Battle of the Atlantic, and perhaps save the lives of hundreds of our seamen. So important was the raid that the Prime Minister sent a message to Air Marshal Harris, A.O.C.-in-C., Bomber Command, in which he described the raid as an "outstanding achievement" which "struck a vital point with deadly precision."

ENEMY AIR LOSSES TO APRIL 18th.

	Over G.B.	Over Continent	Middle East
April 12	0	4	5
,, 13	0	1	6
,, 14	0	5	4
,, 15	0	3	6
,, 16	0	6	0
,, 17	1	4	0
,, 18	1	0	1
	2	23	22

Totals : North, 5,765 ; Middle East, over 3,703 ; Far East (unofficial) 496.

No Qualitative Parity with Allied Equipment : Weakness in Replacement Capacity : Reliance on Foreign Designs : Problem of Skilled Labour : Representative Types Now in Service

By DR. V. L. GRUBERG

WITH Japan joining the Axis Powers in their bid for world domination began the third and final act in the long drama of the "Eastern Co-Prosperity Scheme." The curtain rose in 1937 on Japan's aggression against China; the second act was swiftly and smoothly put over with her occupation of French Indo-China. The present act will be the most dramatic, and more likely to close with a "traditional *hara-kiri*" than with a "Happy ending."

In the struggle which Japan has forced upon the Far East, the air arm, in close co-operation with naval forces, is playing and will continue to play an important role. And it is the air arm which is not as strong as the other tentacles with which Japan is trying to strangle the countries around the Pacific.

In the face of the Japanese successes this statement may sound over-optimistic, and a misjudgment of the striking-power of Nippon. But the successes scored by the Japanese in this initial stage of the Pacific War do not testify to the capacity of Japan's Air Potential. In these operations there was a combination of factors strongly in Japan's favour: first the advantage of the initiative, secondly the unsatisfactory preparation for the defence and inadequate supplies of equipment of the Allies, and thirdly the widespread and highly efficient fifth column and intelligence work of the Japanese.

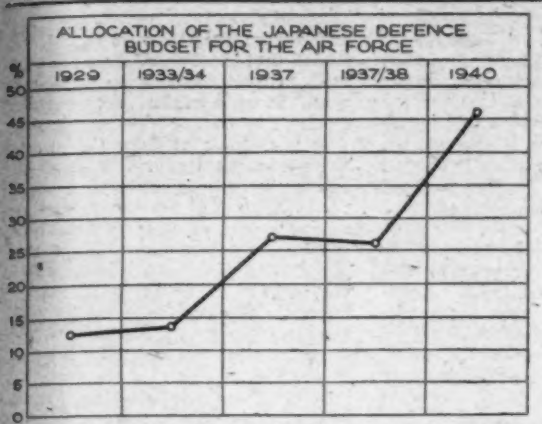
How They Began

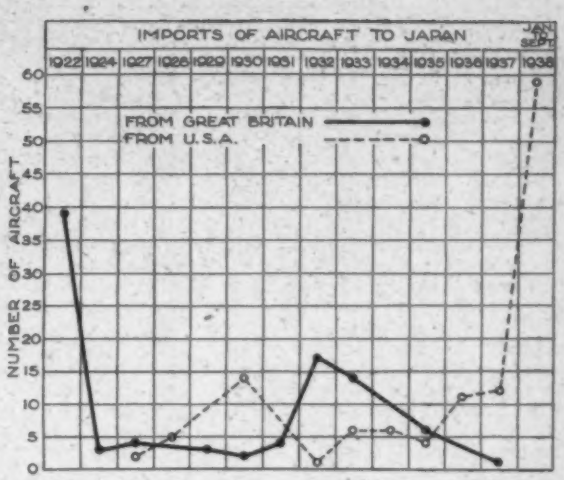
While we have to acknowledge the excellent large-scale planning of Japanese strategy and their ability to co-ordinate the various small actions into a mozaic kind of operation, we should not attribute to Japan's air power something which is not its due: superiority to or even qualitative parity with the equipment of the Allied Air Forces.

Though mystic secrecy has shielded Japan's growing air fleet, it was known that the number of aircraft at the disposal of her forces was larger than that which the Allies could muster at the start of military operations in this theatre of war. Admittingly, the Japanese have exploited this local superiority to the maximum. But the number of planes available

NIPPON FIGHTERS. A batch of Nakajima 97s, which are the most commonly encountered type in their class, resemble the earlier Boeings. Note the two-bladed airscrew and fixed undercarriage.

JAPAN'S AIR POWER





at the beginning of military operations is by no means evidence of aerial strength. Air power has deeper roots: it is the composite result of a country's industrial capacity to produce serviceable types of aircraft at a rate necessitated by the need for replacements, and the resources of man-power, skill and material behind such production.

Lacking in technical skill, the Japanese started to build up their air power by relying on foreign support. Up to 1926 practically all aircraft had been procured by outright purchases from European countries and the U.S.A. Since then concentrated efforts have been made to develop a domestic aircraft industry. But the absence of designing knowledge and craftsmanship made the Japanese rely on buying foreign licences and prototypes. Not only did the licence agreements burden the aircraft industry with some 20 to 30 per cent. of the value of the finished aircraft, but since foreign manufacturers were reluctant to dispose of their latest developments, the Japanese industry could not keep pace with technical improvements in Europe and the U.S.A.

Expansion Drive

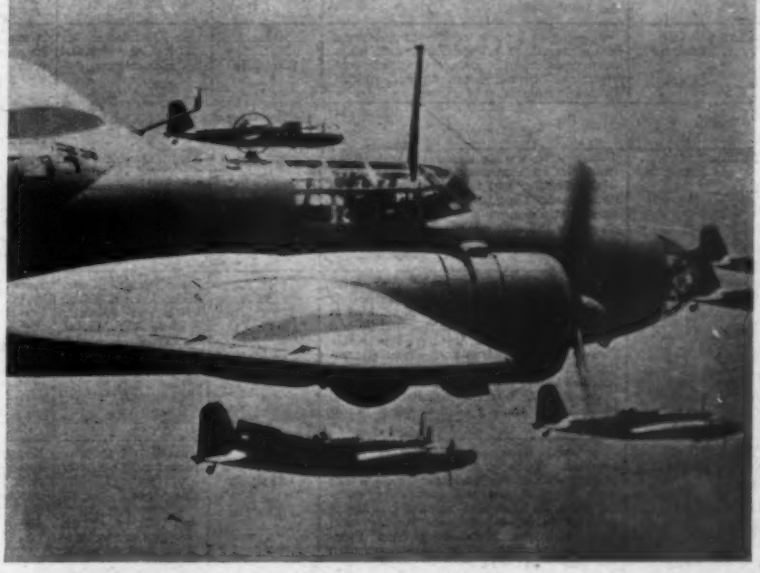
With the beginning of the armament programme in 1931 a steady expansion of the industry can be noted, well reflected by the increasing allocations for the Air Force in the Japanese military expenditure. This trend is graphically shown in the diagram; but one should not overlook the fact that, although it significantly illustrates the growing importance of air power in Japan's military preparations, allowance has to be made for the reduction in the purchasing power of the "Yen," and on the other hand for expenditure provided for building the Air Arm out of public loans and donations which is not included in the diagram.

A real aircraft rush started in 1937 with the opening up of the "China Incident." The Mitsubishi, the Showa Hikoki, and other concerns expanded their production capacities; firms manufacturing instruments, cycles, etc., rushed to the lucrative construction of aircraft. The Government then harnessed the industry into its war machine proper, and by a law of March 11th, 1938, the manufacture of aircraft, engines, airscrews and parts was made subject to a licence, and no foreign licences were allowed to be bought except with the Government's permission. The importation of equipment was declared free of duty, and aircraft firms were released from payment of taxes for a period of five years. Despite these efforts, however, the imports of foreign equipment, though considerably reduced, have still retained a high level.

The Japanese have acquired foreign licences ranging from the Oerlikon cannon and the Hispano-Suiza Moteur-canon to bombers and fighters. Though burdened with the heavy expenditure involved in such purchases, their unscrupulous emulation has helped them to liberate their aircraft industry from the restrictions of various patent laws to which foreign industries were subjected. This was also the shortest cut to obtaining modern equipment without the long period of development and expense connected with it, for which Japan had neither the financial nor the technical resources.

Production Capacity

The production capacity of Japan's aircraft is, for an outside observer, extremely difficult to judge. For reticent as the Japanese have always been in disclosing any information about their military potential, they have sur-



MITSUBISHI T-97: These heavy bombers, which equip the Japanese army squadrons are in extensive use in the Pacific area. It has a range of 1,180 miles with a 4,400 lb. bomb load.

JAPAN'S AIR POWER

rounded their aircraft industry with a veritable nimbus of mystery increased by the difficulty of language. It is only possible to fathom it by comparisons and methods which do not justify absolute reliance on the results so obtained.

As already mentioned, since 1936-7 the production of aircraft was given a new impetus by the Government lead and big orders placed with the industry. Russian sources estimate the capacity in 1937 as being 3,000 machines per annum. While all types of aircraft are included in this figure, it is important to note that since then all efforts have been made to expand further. Thus between December, 1936, and July, 1940, the increase in the percentage of workers employed in privately owned factories was 40 per cent. for the metal industry, 200 per cent. for the machine and tool industry and 40 per cent. in the production of precision instruments.

In this connection it is of relevant bearing that between 1936 and 1940 the value of machine tools purchased by the Japanese industry increased by 500 per cent. If the reduction in exchange rate of the Yen and the simultaneous increase in prices of machine tools is allowed for, we still have an increase of some 400 per cent. Now, since the importation of machine tools was prohibited, except for munition and export industries, it may be assumed that the aircraft industry benefited to the extent of some 200 per cent. increase from the imported machine tools.

It is difficult to draw any conclusions from these figures as to the aircraft actually manufactured, since no doubt only a proportion of the machines was installed, the rest being held back as reserve for an emergency. But if we apply the rate of increase in the machine tools to the production capacity of aircraft, it would mean that by 1940 the Japanese aircraft industry was capable of a total output of some 10,000 aircraft per year.

This capacity is distributed over the

ARMY

FIGHTERS

Type	General Description	Dimensions: Span, Length, Wing Area	Power Plant	Performance	Armament
Kawasaki T95	Single-engine biplane with split axle undercarriage. Wings of unequal span, top wing carried above fuselage on "N" struts. Fuselage straight-sided with rounded top, apparently metal covered. Open cockpit.	32.8ft. 26.2ft. 230 sq. ft.	1 Kawasaki 12-cyl. "V" liquid-cooled of 800 h.p. at 11,500ft., 3-bladed metal airscrew.	Normal weight 4,000 lb. Maximum speed 250 m.p.h. at 13,000ft. Service ceiling 33,000ft. Cruising speed 210 m.p.h. with a range of 300 miles or 1.4 hrs. on 65 gallons.	3×7.7 mm. fixed forward fuselage.
Kawasaki T97 (Mitsu 97).	Of Mitsubishi design, single-engine low-wing monoplane with fixed single-leg type undercarriage. Fuselage of oval cross-section metal construction. Spatted wheels.	36ft. 24ft. 141 sq. ft.	One Kawasaki 102 14-cyl. air-cooled radial of 850 h.p. at 13,000ft. V.P.	Normal weight 4,600 lb. Maximum speed 290 m.p.h. at 15,000ft. Service ceiling 32,000ft. Cruising speed 255 m.p.h. with a range of 335 miles or 1.31 hrs. on 67 gallons.	1×7.7 mm. fixed forward fuselage. 2×7.7 mm. fixed forward wings. 1×7.7 mm. movable dorsal.
Mitsubishi T97	Another version of the Kawasaki T97, but with a different power plant and armament.	—	—	Normal weight 4,400 lb. Maximum speed 265 m.p.h. at 13,000ft. Service ceiling 29,000ft. Cruising speed 230 m.p.h. with a range of 375 miles or 1.63 hrs. on 60 gallons.	4×7.7 mm., probably 3 forward and 1 dorsal, all fixed.
Nakajima T97 ...	Single-seater. Also produced by Kawasaki, single-engine low-wing monoplane with fixed single-leg type undercarriage. Fuselage of oval section, metal stressed-skin construction. Wings with rounded tips, large tail fin with rounded tip and rounded rudder trailing edge.	As above	One Hikari 9-cyl. air-cooled radial of 800 h.p. at 15,000ft., 2-blade fixed pitch airscrew.	Normal weight 4,400 lb. Maximum speed 270 m.p.h. at 15,000ft. Service ceiling 33,000ft. Cruising speed 234 m.p.h. with a range of 340 miles or 1.45 hrs. on 67 gallons.	2×7.7 mm. fixed forward fuselage.
Kawasaki T98 (Kawa 102)	Single-engine biplane with split axle type of undercarriage. Staggered braced wings of unequal span. Mainly of metal construction. Rounded tail fin and rudder, braced tail-plane.	29ft. 23ft. 236 sq. ft.	One Kawasaki of 820 h.p. at 10,000ft. 3-blade airscrew.	Normal weight 5,000 lb. Maximum speed 270 m.p.h. at 10,000ft. Service ceiling 32,000ft. Range probably 350 to 400 miles.	2×7.7 mm. fixed forward fuselage. 2×30 mm. fixed forward wings.

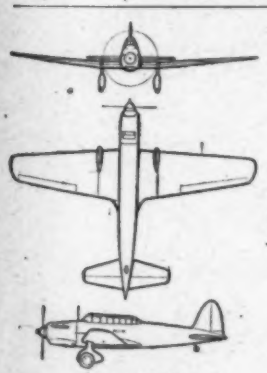
BOMBERS

Kawasaki T.97 ... (Kawa 95)	Twin-engine, low-wing monoplane with retractable undercarriage. Wings have a slight dihedral and taper to rounded tips, flaps fitted. Long perspex-covered cockpit over centre section and transparent nose. Single fin tail unit. Retractable tail wheel. Crew 5 to 7.	75ft. 62ft. 665 sq. ft.	Two Kawasaki 98 air-cooled radials of 820 h.p. 3-blade airscrews.	Normal weight 20,900 lb. Maximum speed 245 m.p.h. at 15,000ft. Service ceiling 24,500ft. Cruising speed 210 m.p.h. with a range of 240 miles or 1.15 hours, carrying 4,400 lb. bombs and 147 gallons. Alternatively 1,250 miles, or 6 hours, carrying 1,100 lb. bombs and 510 gallons.	2×25 mm. and 1×7.7 mm. forward fuselage (?), 2×7.7 mm. moveable dorsal. 1×7.7 mm. movable ventral.
Mitsubishi T.97 ...	Twin-engine, low-midwing monoplane with retractable undercarriage. Tapered wings with rounded tips and split flaps. Wing root fillets. Single fin with rounded tip and nearly vertical rudder, trailing edge. Metal stressed skin construction. Well streamlined fuselage with perspex nose. Tail of fuselage tapers to cone, which may contain a fixed M.G. in some instances. Dorsal cockpit over trailing edge of wing. Crew, 5 to 7.	73ft. 62ft. 675 sq. ft.(?)	Two Kinsei 14-cyl. air-cooled radials of 870 h.p. at 10,000ft., 3-blade V.P. metal airscrews.	Normal weight 22,000 lb. Maximum speed about 220 m.p.h. at 10,000ft. Service ceiling 22,000ft. Cruising speed 190 m.p.h. with a range of 1,180 miles, or 6.2 hours, carrying 4,400 lb. bombs and 540 gallons.	2×7.7 mm. free forward fuselage. 2×7.7 mm. free dorsal turret. 2×7.7 mm. free lateral. 1×7.7 mm. fixed in tail-cone.
Mitsubishi T98 ... (Mitsu 100)	Developed from Mitsubishi T93 Army bomber. Twin engine, low-wing monoplane; retractable undercarriage. Wings with rounded tips and root-fillets, twin-rudder braced tail unit, rudders and fins of angular shape, set between fuselage and tips of tailplane. Metal construction. Fuselage of rectangular cross-section with rounded top surface, perspex-covered cockpit over central section and large spherical gun turret in nose. Probable dorsal gun position in open cockpit over wing root fillets. Crew 4 to 5.	75ft. 59ft. 685 sq. ft.	Two Mitsubishi air-cooled radials of 750 h.p. at 15,000ft. Long-chord engine cowlings are fitted and the crankcase cowlings are adjustable. 2-blade metal airscrews.	Normal weight 21,000 lb. Maximum speed 220 m.p.h. at 15,000ft. Service ceiling 23,000ft. Cruising speed 185 m.p.h. with a range of 1,180 miles or 6.4 hours carrying 2,200 lb. bombs and 480 gallons.	1×20 mm. free forward fuselage 2×7.7 mm. fixed forward wings, 2×7.7 mm. free dorsal.

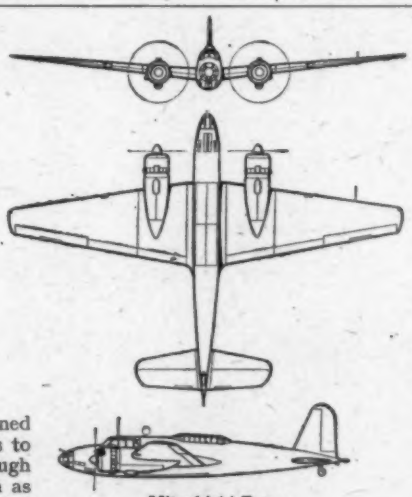
These tables are based upon information obtained from the British Air Ministry.

LIGHT BOMBER RECONNAISSANCE

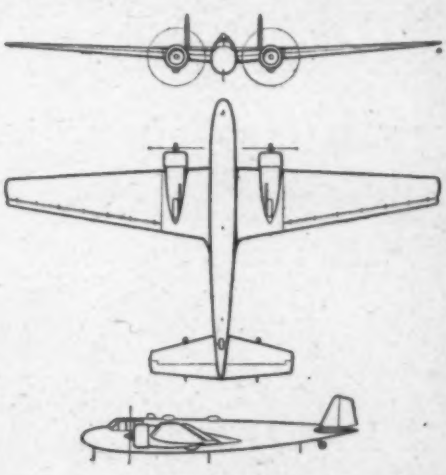
Type	General Description	Dimensions: Span, Length, Wing Area	Power Plant	Performance	Armament
Nakajima T94 ...	Single-engine biplane with fixed split undercarriage of wide track. Wings elliptical in plan form and of unequal span. Interplane struts of "N" formation slope sharply. Fabric covered structure. Open cockpits. Crew 2.	39.5ft. 26.2ft. 323 sq. ft.	One Kotobuki air-cooled radial of 600 h.p. at 11,000ft. ? 2-blade, fixed pitch, metal airscrew.	Normal weight 5,720 lb. Maximum speed 175 m.p.h. at 13,000ft. Service ceiling 23,000ft. Cruising speed 150 m.p.h. with a range of 470 miles or 3.1 hours on 104 gallons.	1×7.7 mm. fixed forward fuselage. 1×7.7 mm. free dorsal.
Kawasaki T97 ...	Single-engine, low mid-wing monoplane with single-leg type fixed undercarriage. Wings tapered with rounded tips, split flaps, and small wing root fillets. Metal, stressed-skin construction, but control surfaces are fabric-covered. The tail unit has a single fin and rudder. Long perspex-covered cockpit with a dorsal gun position, or, alternatively faired into the fuselage. Spatted wheels. Crew 2.	47.7ft. 295 sq. ft.	One Kawasaki 12-cyl. liquid cooled of 900 h.p. at 6,500ft. 3 V.P. metal airscrew.	Normal weight 7,000 lb. Maximum speed 236 m.p.h. at 13,000ft. Service ceiling 25,000ft. Cruising speed 206 m.p.h. with a range of 490 miles, or 2.38 hours, on 100 gallons.	1 or 2×7.7 mm. fixed forward fuselage. 1×7.7 free dorsal.
Mitsubishi T97 (Mitsu 103)	Single-engine, low-wing monoplane with single-leg fixed undercarriage. Metal construction. Crew 2 to 3.	—	One Mitsubishi 14-cyl. air-cooled radial of 900 h.p. at 12,000 ft. ? 2-blade metal V.P. of Hamilton type airscrew.	Normal weight 8,000 lb. Maximum speed 260 m.p.h. at 13,000ft. Service ceiling 27,000ft. Cruising speed 210 m.p.h. with a range of 750 miles, or 3.3 hours, carrying 660 lb. bombs and 168 gallons. With 1,000 lb. bombs and 130 gallons range is 500 miles.	1 or 2×7.7 mm. fixed forward fuselage. 1×7.7 mm movable dorsal.
Mitsubishi T97 ...	Another version of the above type, but with a different power plant and armament. Crew 2.	40 ft. 27ft. 215 sq. ft.	One Kotobuki air-cooled radial of 800 h.p. 2 blade metal airscrew.	Normal weight 5,750 lb. Maximum speed 260 m.p.h. at 15,000ft. Cruising speed about 220 m.p.h. with a range of 960 miles, or 4.25 hours, on 180 gallons. Alternatively with bombs in place of fuel, 450 miles, carrying 660 lb. bombs and 100 gallons.	2×7.7 mm. fixed forward fuselage. 1 or 2×7 mm. free dorsal.
Mitsubishi T98 ...	Similar in appearance to the "Karigane" Mark II. Single-engine, low-wing monoplane with fixed cantilever undercarriage. Cantilever wing and tail surfaces, of moderate taper. Fitted flaps. Large root fillet. Stressed-skin metal fuselage. Crew 2.	39.5ft. 27.9ft. 258 sq. ft.	One Mitsubishi A. "Kinsei" 14 cyl. 2 row air-cooled radial of 900 h.p. at 10,000 ft.	Maxhmum speed estimated 240 m.p.h. to 260 m.p.h. Cruising speed estimated 200 m.p.h. Normal bomb load 650 lb., maximum 1,000 lb.	2×7.7 mm. fixed forward wings. 1×7.7 mm. free dorsal.
Mitsubishi T98 ... (Mitsu 104)	A variation of the above with fixed single-leg type undercarriage. Small wing root fillets. Split flaps. Cantilever tail unit of triangular shape. Perspex cockpit. Crew 2 to 3.	46ft. 26.2ft. 290 sq. ft.	One Mitsubishi air-cooled radial of 900 h.p. at 9,000ft. ?	Normal weight 7,800 lb. Maximum speed 250 m.p.h. at 11,000ft. Service ceiling 25,000ft. Cruising speed 208 m.p.h. with a range of 280 miles, or 1.24 hours, carrying 1,230 lb. bombs and 70 gallons.	As above. Alternative armament 2×20 mm. guns in the wings and 2×7.7 mm. free dorsal guns.
Showa T99 ... (Sho. 99)	Single-engine, low-wing monoplane with retractable undercarriage. Tapered wings and rounded tips, slight dihedral, single-fin tail. Metal construction. Rounded fuselage with long perspex-covered cockpit.	50ft. 37ft. 335 sq. ft.	One Showa air-cooled radial of 850 h.p. at 5,800ft. 2-blade metal airscrew.	Normal weight 9,700 lb. Maximum speed about 220 m.p.h. at 6,800ft. Cruising speed 180 m.p.h. with a range of 950 miles or 5.1 hours, carrying 600lb. bombs and 200 gallons. Alternatively, 880 miles with 2,280 lb. bombs.	1×7.7 mm. fixed forward fuselage. 2×20 mm. fixed forward wings. 1×7.7 mm. free dorsal.



Kawasaki T97



Mitsubishi T97



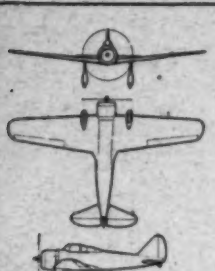
Mitsubishi T96

private and Government-owned plants of which Japan seems to have a fair number. Although the main aircraft firms, such as Mitsubishi; the Showa (founded in 1937 with the participation of the Army and Navy), the Sumimoto Metal Co., and the Turukawa Co., and the Nakajima, are the major concerns engaged in the production of airframes, there is a host of others either controlled by the super-financial houses of Mitsubishi or other groups sponsored by the Government.

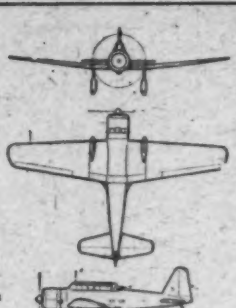
A recent Italian estimate puts the figure of aircraft firms as high as 15 and that of aircraft engines as ten. If all plants engaged in the production of aircraft and engines are included in this figure, it may be assumed that it represents as nearly as possible the actual size of Japan's aircraft industry.

The technical efficiency of this industry is still very much hampered by the limited resources of skilled labour and technical development. As late as 1937, the Japanese "Ekonomisuto" ascribed the difficulties of the Japanese aircraft industry to the inadequate supply of materials and the undeveloped machine industry. Since then the position has considerably improved, but to a large extent Japan continued to depend, practically until her entry into the war, on foreign supplies of complicated machine tools and

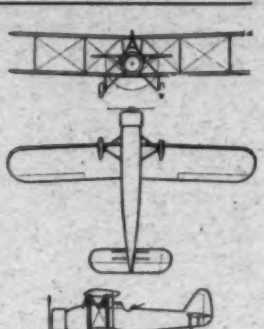
JAPAN'S AIR POWER



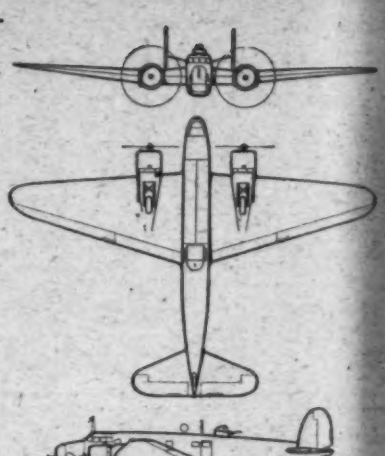
Nakajima T.97.



Mitsubishi T.98.



Mitsubishi T.96 Army and Navy Dive-bomber.



T.98 Heavy bomber (Army and Navy).

special ferro-alloys. To counteract this deficiency the Government established special training centres and acquired plants where large numbers of workers could become proficient in various skilled trades.

Nevertheless, the problem of skilled labour remains a constant deterring factor in Japan's air expansion. The Japanese aircraft industry is lacking that depth of skilled labour resources on which the aircraft industry in Western countries can draw in the hour of rapid expansion. Although at present this shortage is not acutely felt, it will undoubtedly impress its stamp on Japan's air potential with the continuity of the war and the manifold calls on the limited resources of skilled and mechanical labour.

Farming-out System

The advance from utter inferiority to the present state of development has been remarkable, but the absence of domestic demand for motor vehicles prevents a substantial growth of the motor industry, which is at present limited to large assembly plants and plants working for army orders. A large proportion of the industry engaged in the production of components and instruments is concentrated in the hands of small workshops spread all over the country. The system is based on the farming-out of work by merchant employers to such workshops employing from five to 30 workers and equipped with presses, lathes and machine tools. The products of these shops are then assembled in the "mother firm" which also supplies them with the necessary materials, drawings, etc.

But while from the point of view of vulnerability to air attacks such dispersal of the production may be an advantage, the atomising of the production process carries serious disadvantages; it allows for a greater laxity in inspection, reduces the uniformity of the finished product, hinders a scheduled balancing of production, and prevents a rapid acceleration of the output. The main drawback of this system, however, is in its failure to produce cadres of skilled labour, so important to any further expansion of the Japanese air power.

Practically right up to their treacherous attack on Pearl Harbour and the outbreak of hostilities, the Japanese have continued to benefit from the generosity of American and British suppliers. Despite embargos, "moral" and other strategic materials continued to reach Japan from sources outside her sphere of influence and outside the control of her Axis partners who, at any rate, had nothing to offer. Since these deliveries have been continuing for some years in quantities surpassing the current consumption of Japan, it is evident that with the help of British, American and Dutch suppliers, she managed to accumulate stocks which will feed her air power in the present struggle against the Allied Nations.

Such is the ironic fate of appeasing *laissez faire*. But this dependence on foreign sources of supply for strategic materials seriously weakens Japan's air potential. For, despite the large resources of Malaya and the Dutch East Indies, it still remains problematic to what extent she will be able to utilise them for her aircraft industry. The stocks, however—no matter how large—cannot ensure the production capacity of her industry commensurate to the heavy requirements of protracted modern warfare.

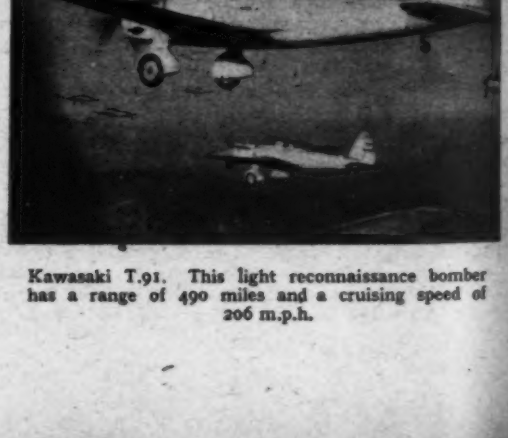
Not only did the Japanese live on the material resources of their present foes, but to a great extent on their technical skill and ingenuity.

While there is no doubt that certain late developments were held back by the very firms which sold the prototype licences, Japan has managed to purchase aircraft which was already in quantity production in the supplying countries. Thus in 1938 she purchased 80 Fiat B.R. 20 twin-engined bombers from Italy. In the summer of 1939 five Focke Wulf 200-Condors were ordered from Germany, of which two are certainly known to have arrived. In August, 1939, the Douglas Aircraft Co. is said to have sold (despite the embargo) the prototype of DC 4 to be manufactured in Japan. She is further reported to have acquired the building rights for Messerchmitt 109, and possibly Heinkel He 112 single-engine fighters, the Me 110, the Junkers Ju 87B single-engine dive bomber, and the Ju 88, as well as the He 111.

Equipment

While these reports have to be treated with due caution, it is unlikely that the above types have already gone into production to any considerable extent. The equipment of the Japanese Air Force still presents a rather "mixed bag," with some types completely obsolete, while the majority of it limps behind the up-to-date American and European developments.

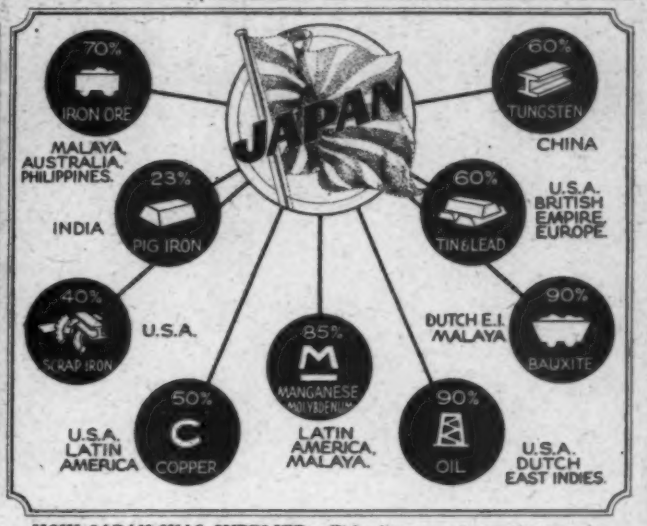
Perhaps in their attempts to intro-



Kawasaki T.91. This light reconnaissance bomber has a range of 490 miles and a cruising speed of 206 m.p.h.

JAPAN'S AIR POWER

POTENTIAL GROUND STAFF : A group of Japanese student-mechanics at an Air Force technical training school study an engine and its airscrew at close quarters.



HOW JAPAN WAS SUPPLIED : This diagram shows the sources of strategic materials which helped to build up Japan's air power.

duce further confusion in the scant knowledge of their air power resources the Japanese have introduced an ingenious method in the classification of their types: aircraft types are designated by numbers, corresponding to the last two figures denoting the year of the Jap. Era in which the machine went into production. Thus the year 2600 of the Jap Era corresponds to the year 1940 of our reckoning, and the type marked "91," for example (or 2591), indicates a machine of the 1931 vintage. This results frequently in two types of different design and purpose bearing the same name, while alterations of one type carried out in the same year do not carry a serial number betraying such modification.

New Types

Although important numbers of biplanes are still in service, a new low-wing fighter aircraft made its appearance in 1936, and has since gradually been replacing the former. Amongst these the single-seater fighter Nakajima T.97 is used both by the Army and the Navy operating from aircraft carriers. While the performance of this type is still behind those of European and American fighters, the Japs have a more recent type, designated "Mitsubishi 00," which would indicate a 1940 production. The performance of this fighter, which is now being extensively used by the Japanese, is inferior to that of the Spitfire and Hurricane. It compares rather with the early Me 109 and has been most likely influenced by German designs. A notable feature of the "00" is the good range, particularly useful for its employment over the wide stretches of the Pacific.

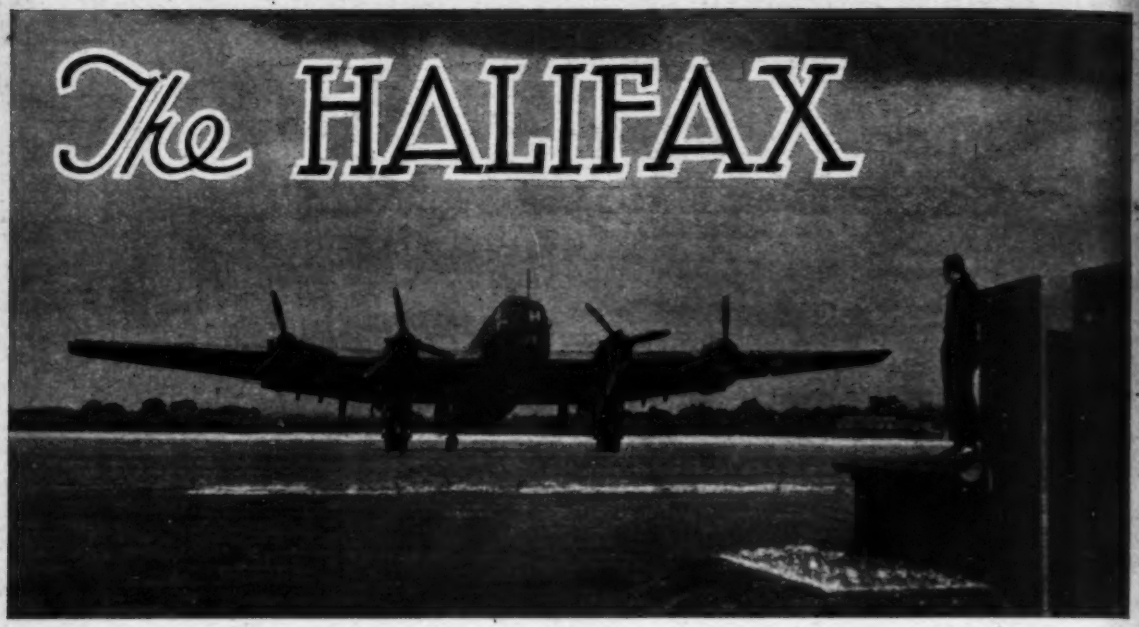
It is possible that with the growing air opposition the Japanese will produce more of their hidden treasures, but there is hardly any doubt that such types will not represent the bulk of the equipment. The accompanying table of Japanese aircraft—while not absolutely complete—may well serve the purpose of showing the representative types of Japanese aircraft at present in service. A glance at this table will show that, while very few types are equipped with twin-row radials, none have power plants in excess of 1,000 h.p.

This in itself is typical of the development of the Japanese aircraft industry, which does not show that constant development displayed by other countries. Nothing extraordinary can be seen in these types, and nothing spectacular should be expected from such aircraft as may yet make their appearance. Indeed, in all these types we clearly see the pattern of evolution of the Japanese aircraft industry which so closely followed always in the steps of their masters: the British, German, French and American designers. This applies both to airframes and engines. The equipment and organisation of Japan's Naval Air Force will be dealt with in the next issue, and a tabulation of Naval Aircraft published.

(To be continued.)

AIRBORNE RATIONS : Japanese airmen loading their aircraft with food containers to which parachutes are attached for dropping to isolated units. The containers are protected by metal frames.

The HALIFAX



A Heavy Bomber with Great Load-carrying Capacity : Same Wing Area as H.P. O/400 of 1915, but 60,000 lb. Loaded Weight Instead of 14,000, and More Than Three Times the Speed

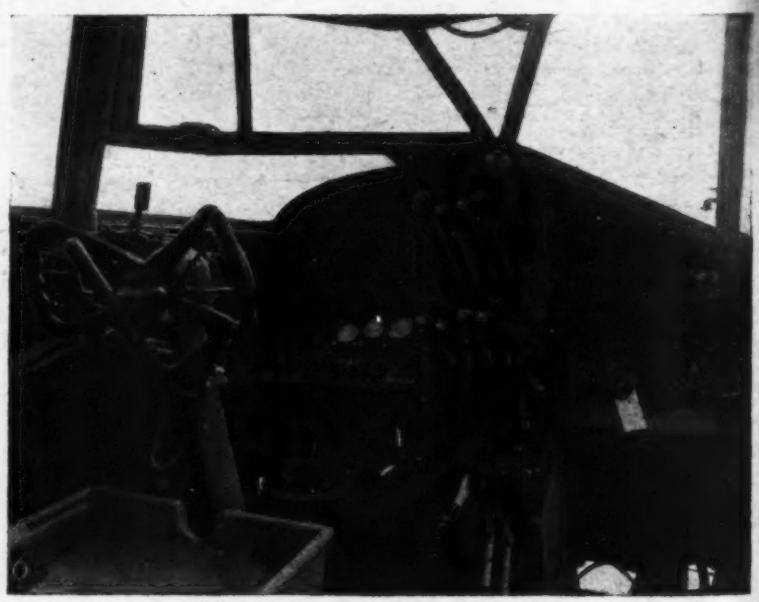
(Illustrated with Exclusive "Flight" Sketches and Photographs)

DURING the war 1914-18 Mr. F. Handley Page delivered a lecture to the Royal Aeronautical Society and stated—very ably, as one might expect of this British pioneer of aircraft design—the case for the large machine. In those days we had all become rather imbued with the idea, sound enough in itself in that it was based upon a fundamental law, that the percentage of structure weight increased rapidly with aircraft size. The law, quite briefly, is that whereas wing area increases proportionately as the square of the wing span, the weight increases as the cube. The law is known as the cube law, and presupposes geometric similarity; that is to say that not only must the external shape of the aircraft remain the same, on the larger scale, but the components of the internal structure must be in every way to scale also, and must be made of the same materials.

What Mr. Handley Page did in his lecture was not to disprove the validity of the cube law, which is an obvious fundamental truth, but to point out that there are many ways in which the cube law can be "cheated." In a small aircraft there are a great many structural components which cannot be made as thin and light as the loads in them demand; they would be too flimsy for handling, or they would need so much additional stiffening to make them rigid enough that their manufacture would become too slow and costly. In other words, "refinements" became possible which would be out of the question in small aircraft. The audience at that memorable lecture was impressed, but still slightly sceptical, although Mr. Handley Page was not merely talking theory, for he had built the H.P. O/400, a large biplane of 100ft. span and 1,480 sq. ft. of wing area.

Since those early days the Handley Page Company has built many large aircraft; the O/400 was followed by the still larger V/1500, and then by smaller bombers such as the Hyderabad, the Hinaidi, the Heyford, the Harrow, the Hampden, and now the much larger Halifax.

The Halifax is the first four-engined bomber produced by the Handley Page firm since the V/1500, and it is not



First pilot's controls and instruments. The second pilot sits on the starboard side and can supervise the instruments mounted on that end of the panel.

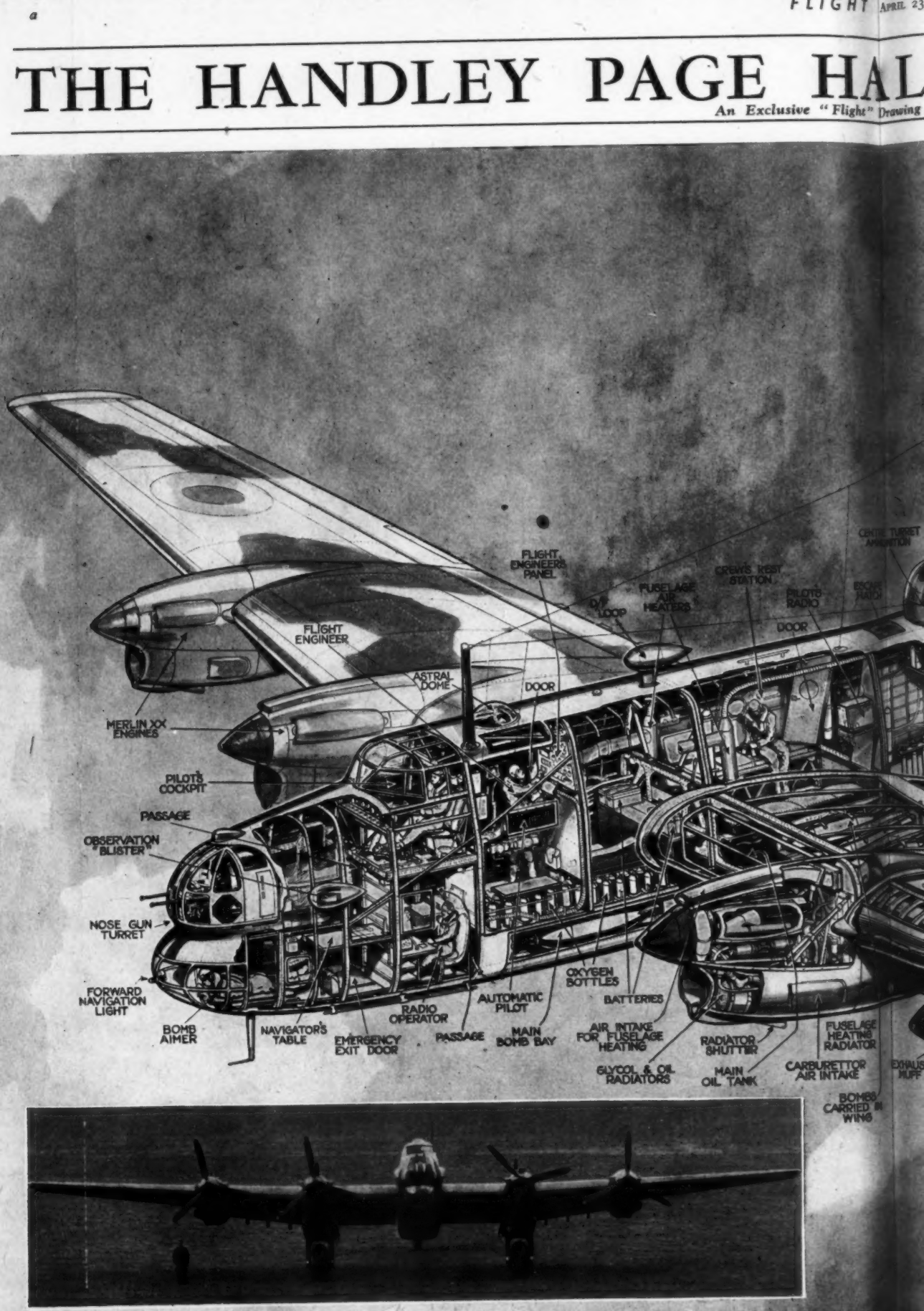
LEAVING FOR THE PARTY — Wellingtons taking-off at dusk

A monochrome reproduction of one of the oil paintings by Frank Wootton commissioned by the Airscrew Division of The de Havilland Aircraft Company which have already realised over £1,200 for the Royal Air Force Benevolent Fund. A limited number of fine art prints, size approximately 17 ins. by 12 ins., in the artist's true colourings are being sold at £1 1s. 0d. each, post free, or £2 2s. 0d. each signed by Frank Wootton. (Sets of six £5 15s. 6d. and £10 10s. 0d. respectively). Half of all remittances is given immediately to the R.A.F. Benevolent Fund and as soon as the actual cost of printing and distribution has been recovered the balance will also be handed on. Orders, accompanied by cheque or postal order, should be addressed to Samson Clark & Co., Ltd., 57-61, Mortimer Street, London, W.1.

The other pictures in the series are: NIGHT WORK—Hurricanes in 1940; A JOB OF WORK TO BE DONE—Defiants en route to Dunkirk, May, 1940; LOOKING FOR TROUBLE—Spitfires in the Battle of Britain; SUNDERLANDS ON CONVOY PATROL; OVER THE TARGET—Weather favours the Blenheims.

THE HANDLEY PAGE HAL

An Exclusive "Flight" Drawing



HALIFAX HEAVY BOMBER

"Flight" Drawing by M. A. Millar.

DIMENSIONS

Wing span : 99ft. Height : 22ft.
Wing area : 1,250 sq. ft. Fuselage height : 9ft. 6in.
Length o.a. : 70ft. Fuselage width : 5ft. 6in.

ARMAMENT

Two Browning .303 machine guns in nose turret
Two Browning .303 machine guns in dorsal turret
Four Browning .303 machine guns in tail turret

WEIGHT AND PERFORMANCE

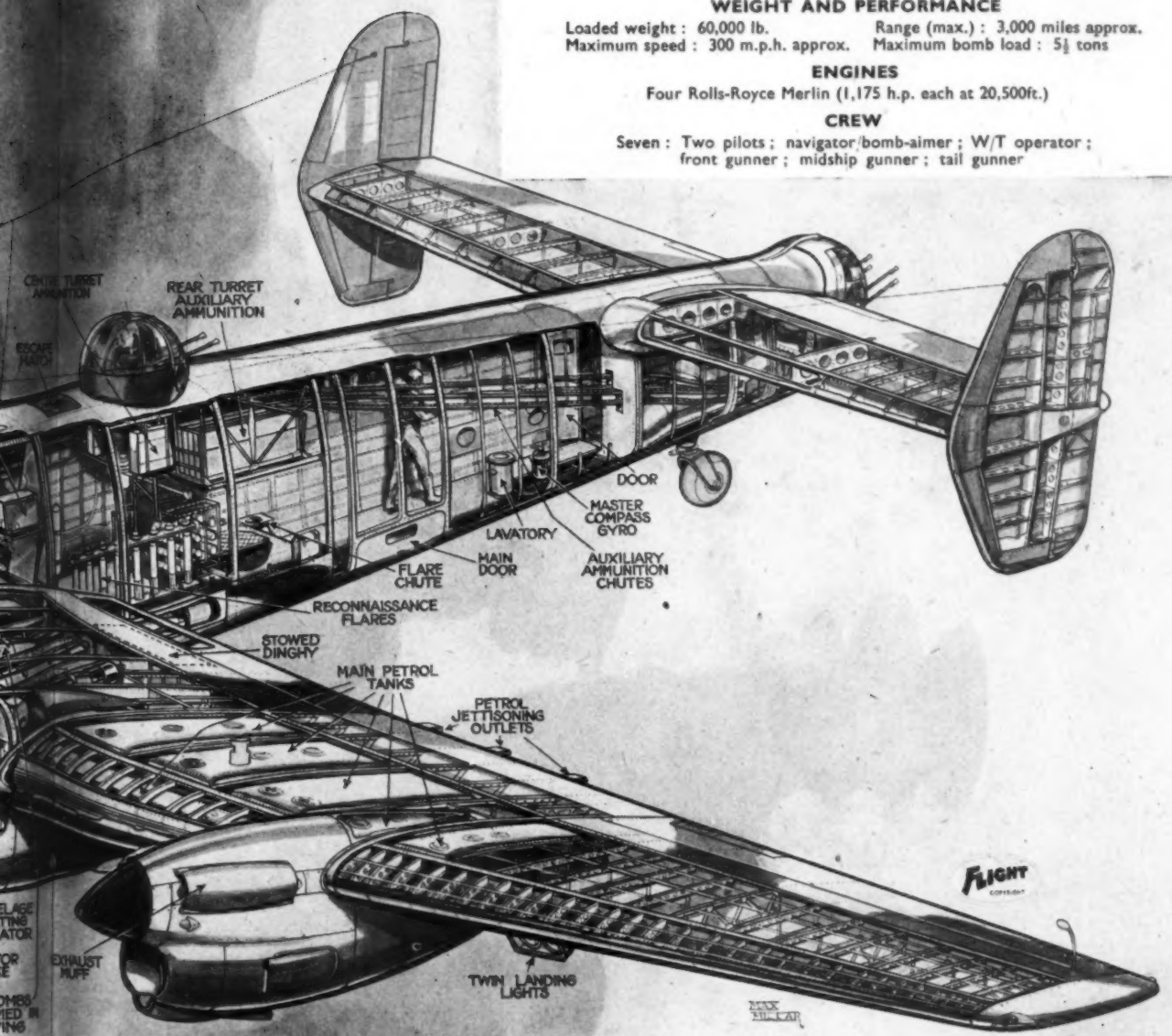
Loaded weight : 60,000 lb. Range (max.) : 3,000 miles approx.
Maximum speed : 300 m.p.h. approx. Maximum bomb load : 5½ tons

ENGINES

Four Rolls-Royce Merlin (1,175 h.p. each at 20,500ft.)

CREW

Seven : Two pilots ; navigator/bomb-aimer ; W/T operator ; front gunner ; midship gunner ; tail gunner



ROLLS RR ROYCE

FOR SPEED AND RELIABILITY

DESIGNERS AND CONSTRUCTORS OF

FOR

AEROPLANES OF ALL TYPES

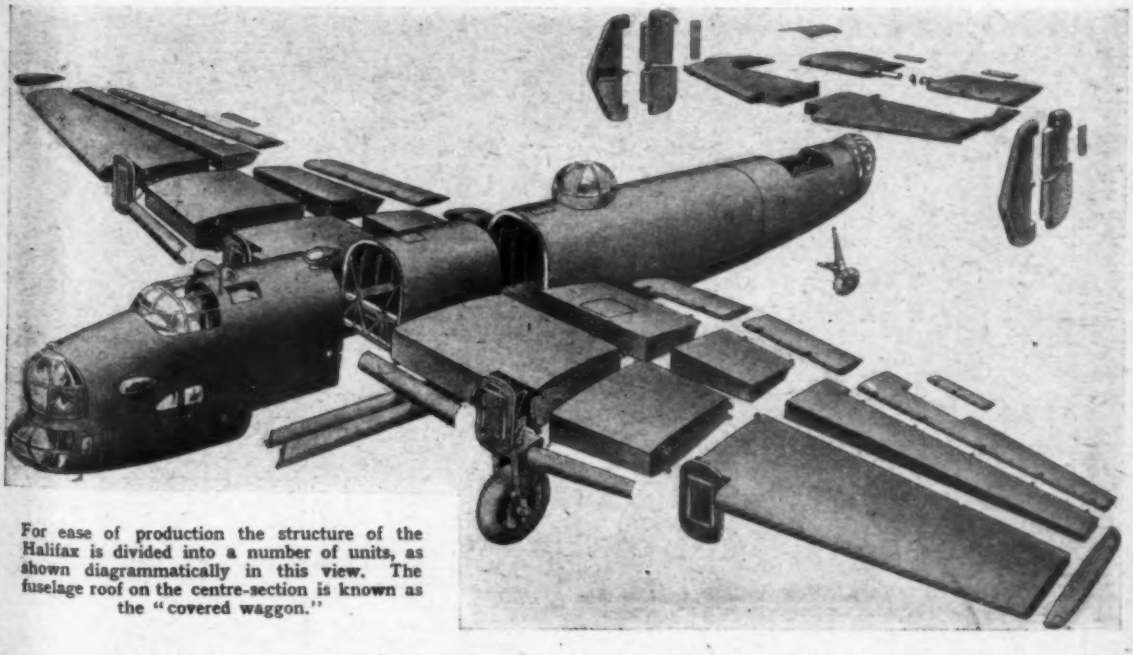
THE HALIFAX

without interest to note that the wing span is the same as that of the O/400 of 1915, and the two wing areas also the same within a little. But whereas the O/400 had a loaded weight of 14,000 lb., the Halifax at full load weighs something like 60,000 lb. Apart from the change to all-metal construction which has taken place, it is this increase in wing loading which has made the Halifax and Short Stirling bombers possible; and it is fair to say that in making this high wing loading possible the Handley Page Company has taken a prominent part. The lift slot and the slotted flap were products of this company, and although the former is not used on the Halifax, the research and development work carried out in connection with it have borne fruit in directions which have benefited design as a whole. Even with such aids to high wing loadings, the heavy bomber of to-day would not have been feasible but for the vast improvement in flying technique and piloting skill which has grown up since the days of the O/400.

The Halifax, at full speed, flies with its tail slightly up, as the wings are set at a fairly large angle on the fuselage so as to obtain the necessary ground angle without the need for a very stilty undercarriage.

In examining the Handley Page Halifax down to the minutest detail, as we have been privileged to do, thanks to the courtesy of the Handley Page Company and the Ministry of Aircraft Production, two things in particular impress us; they appear contradictory but are not so in fact. One is that the tremendous task of first producing thousands of drawings and scores of jigs, without which the aircraft could not be produced at all, has been possible, so that actual production can be, and is, on quite a large scale. The other is that, for an aircraft which has to carry the complexity of equipment which an inspection of the Halifax discloses, the primary structure is remarkably simple. The only complication in the machine is that which is due to the nature of the equipment. No complication is caused by the structure having to carry its stresses as such.

The function of the Halifax being to carry the greatest possible bomb load the longest possible distance, with sufficient speed to get to distant targets during the darkness of night, the general characteristics were determined by the fact that no aircraft engine was available, two units of which would lift the desired load at the necessary speed. The machine had, therefore, perforce to be a four-engined type. That introduced complication number one. Not only had engine instruments and controls to be quadrupled, but the fuel system became more involved owing to the fact that any and all engines had to be capable of being fed from any and all tanks, and a greater quantity of fuel had to



For ease of production the structure of the Halifax is divided into a number of units, as shown diagrammatically in this view. The fuselage roof on the centre-section is known as the "covered waggon."

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be carried so as to supply the extra power.

Then came the question of bomb load. Had it merely been desired to carry one very large bomb in a bay in the fuselage, the matter would have been simple. The concentrated load would have been large, but there would have been no difficulty in providing for that. It is, however, not on every raid that a single or even two very large bombs will be the most suitable cargo. There are times when a larger number of smaller bombs are more appropriate to the target; and so provision had to be made for stowing some bombs in the wings and some in the bomb bay in the floor of the fuselage. They could, presumably, have been worked into the design by making the bomb bay very long, but that would have introduced difficulties with the centre of gravity, which would have moved so far in a fore and aft direction that serious instability might well have arisen unless front and rear bombs were dropped simultaneously, a procedure which might not always be desirable.

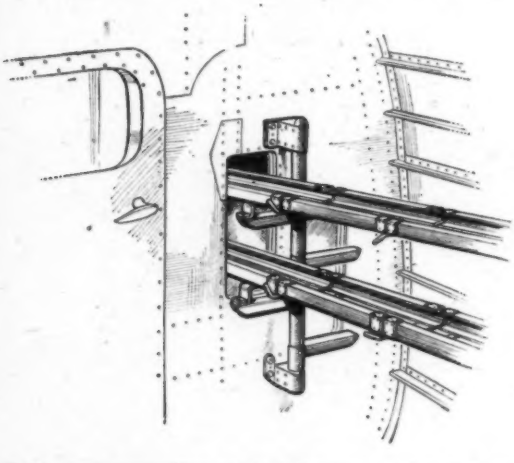
View in the rear compartment looking aft and showing ammunition rails. The door in the background leads to the tail gunner's compartment.

Considerations such as those outlined led to the Halifax becoming what it is, a four-engined cantilever monoplane, with the wing set approximately half-way up the sides of the fuselage. Defensive armament had to be provided in nose and tail, as well as on top of the fuselage, although we have never quite understood why a nose turret should be needed in a heavy night bomber, which is not likely to attack any hostile aircraft except fighters, and they are not likely to attack from in front.

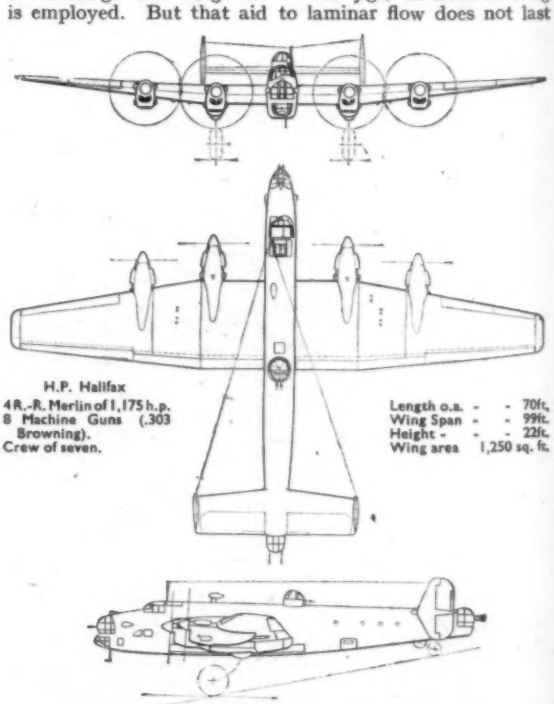
General Design

With such questions as number of engines, load of bombs and number of gun turrets settled beforehand, the general design could be begun, and the outline sketched out. The proportions of the Halifax are so good that the great size of the aircraft does not obtrude itself on the onlooker. It looks large, certainly, but does not convey an impression of 27 tons hurtling through the air at 300 m.p.h. or so. We imagine that Mr. Volkert, Handley Page's chief designer, made good use of his project engineer, Mr. Haines, in deciding upon the lines of the machine, which are uncommonly good. It is not very difficult to make a small aircraft pretty, but it is very easy to make a large one look ugly. That has been avoided in the Halifax, which is easily the best-looking machine that firm has produced. The nose and tail gun turrets have been worked into the lines in a way that is very pleasing, and only the dorsal turret mars the continuity; that, however, was unavoidable. A "dustbin" underneath would be even worse as an eyesore.

The surface of the Halifax is perfectly smooth when the fuselage and wings leave their jigs, as flush-riveting is employed. But that aid to laminar flow does not last



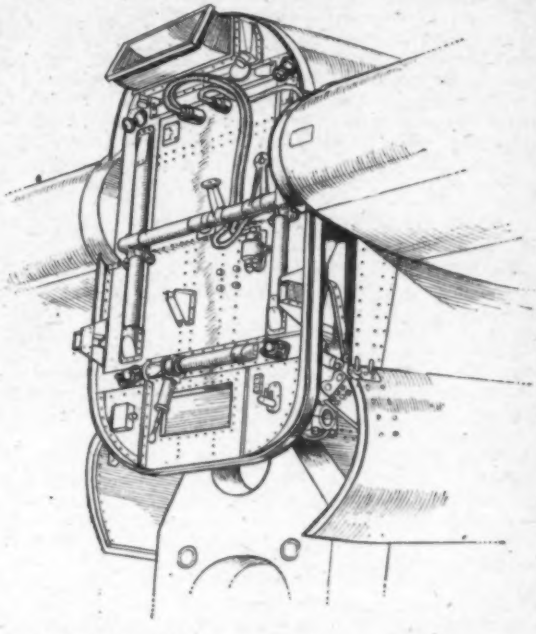
Rails carry ammunition to the tail gunner. Here they are shown at the point where they pass through the bulkhead of the tail compartment.


H.P. Halifax
4 R.-R. Merlin of 1,175 h.p.
8 Machine Guns (.303 Browning).
Crew of seven.
Length o.a. - - 70ft.
Wing Span - - 99ft.
Height - - - 22ft.
Wing area 1,250 sq. ft.

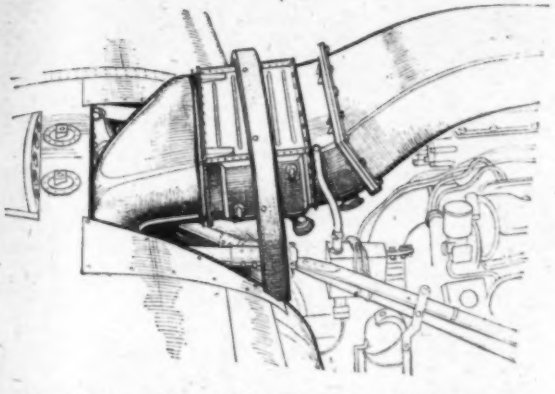
very long; in fact, it never sees the light of day, for in the dope shop is applied, on all under surfaces, that most black and most matt of all paints, the night-bomber black which reflects practically no light from the searchlights, but which must reduce the speed quite as much as would ordinary round-headed rivets.

Inside the fuselage the space is divided into a number of compartments for the various members of the crew. In the extreme nose is the position for the prone bomb-aimer, and as he is also the navigator his folding chart table, instruments, etc., are in the same compartment, a little farther aft. Above him, on the top floor, is the front gunner's turret, with two Browning .303 machine guns and their ammunition. Separated from the navigator's compartment by a partition which runs half-way across the width of the fuselage is the wireless operator's cabin, and above that the pilot's cockpit. Then follows the compartment for the flight engineer, who supervises a number of indicators. He has a folding seat and sits with his back to the second pilot on the starboard side of the cabin. The flight engineer's compartment is closed at the back by an armour plate bulkhead and door. Then follows a large compartment, which extends from the flight engineer's bulkhead to the rear wing spar, above which is a wooden bulkhead, which is really more of a draught screen than anything else, and aft of that is a large stowage space in which a swinging ladder gives access to the dorsal gun turret. This turret has two Browning .303 machine guns.

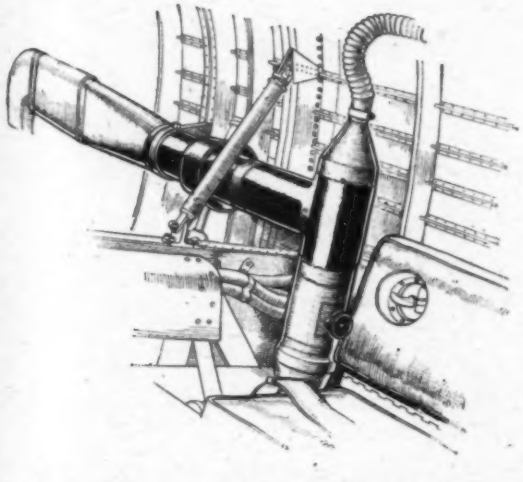
Aft of the turret is a w.c. screened off by a black curtain, and a drop in floor level affords head room to walk right



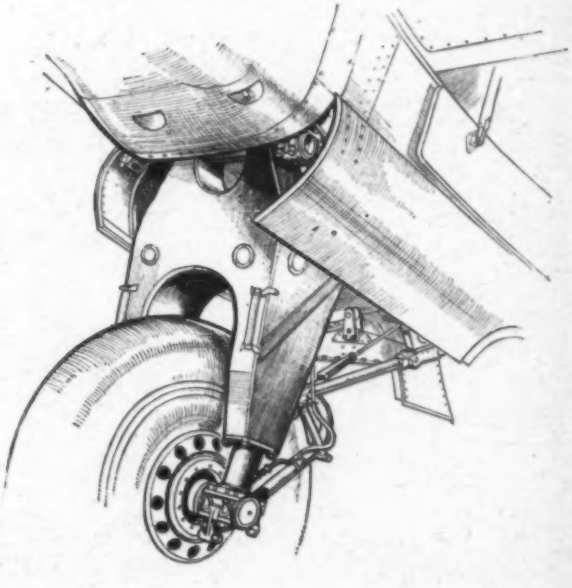
The bulkheads of the inboard engines are mounted at the ends of the wing centre section. The intermediate wing portion is shown in place in this view, as is also the undercarriage. The four pick-up points for the engine-bearers are shown. They are in the form of ball and socket joints. The radiator at the top heats the air used for warming the crew's stations.



The radiator on the port inboard engine bulkhead supplies hot air through a large pipe to the crew's stations inside the fuselage.



Heating air for the crew's stations is taken from a special radiator in one of the engine nacelles. Smaller branch pipes lead to different parts of the fuselage so as to heat the whole. The handle in the recess operates the undercarriage "up" lock if the hydraulic system should fail.



The Messier undercarriage of the Halifax carries Dunlop wheels fitted with pneumatic brakes. The wheel fork is a huge light-alloy casting.

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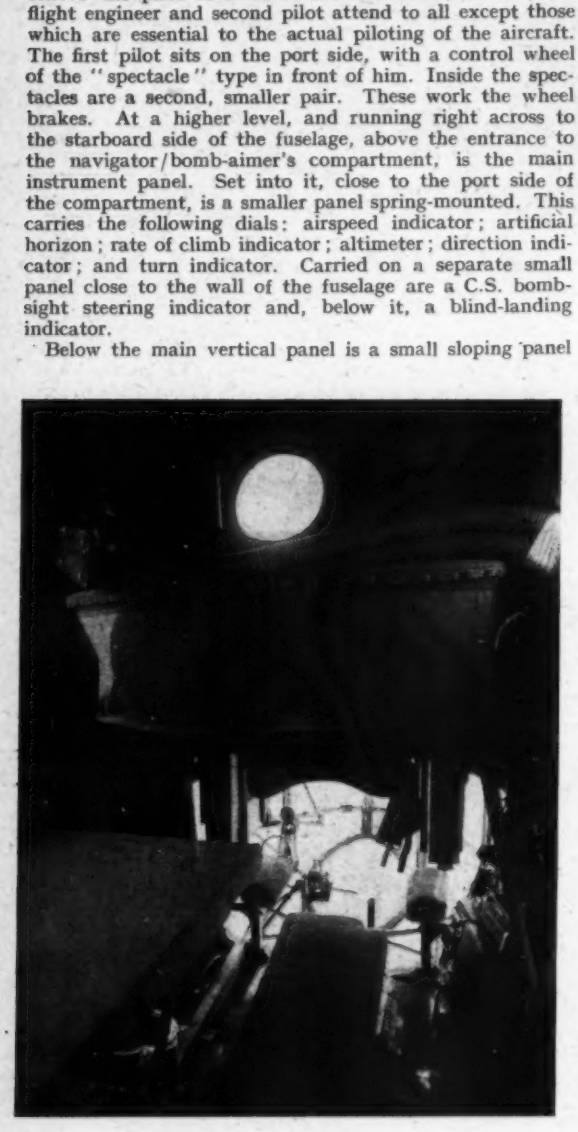
up to the sheet-metal partition which separates the fuselage from the tail wheel compartment and tail gun turret. The latter is a real sting in the tail, mounting four .303 Brownings, which must compensate "tail-end Charlie" quite a lot for his somewhat lonesome post and separation from the rest of the crew.

The bomb bay is, of course, located under the fuselage floor. Having seen the general layout, which in the main shows the gangway and clear space on the starboard side, the equipment on the port, it may be of interest to go back and examine in more detail some of the equipment and its location.

Lightening the Pilot's Task

By carrying a crew of seven it has been possible to relieve the pilot of some of the indicators; in fact, the flight engineer and second pilot attend to all except those which are essential to the actual piloting of the aircraft. The first pilot sits on the port side, with a control wheel of the "spectacle" type in front of him. Inside the spectacles are a second, smaller pair. These work the wheel brakes. At a higher level, and running right across to the starboard side of the fuselage, above the entrance to the navigator/bomb-aimer's compartment, is the main instrument panel. Set into it, close to the port side of the compartment, is a smaller panel spring-mounted. This carries the following dials: airspeed indicator; artificial horizon; rate of climb indicator; altimeter; direction indicator; and turn indicator. Carried on a separate small panel close to the wall of the fuselage are a C.S. bomb-sight steering indicator and, below it, a blind-landing indicator.

Below the main vertical panel is a small sloping panel strip carrying oxygen flow meter; auto-control pressure indicator; air temperature gauge; repeater compass (the master gyro compass is mounted in the rear fuselage compartment); wing flap indicator; four boost gauges and four double main engine switches; the undercarriage indicators and the bomb firing switch. These dials are all under the eyes of the first pilot—and quite enough, one would say—but only a fraction of what he would have to survey if a flight engineer were not carried.



The prone bomber's station in the nose. Above it on the left is the navigator's table. The circular window at the top is just behind the nose gun turret.

The crew's rest station has upholstered settees along the sides. The large tubes on the right are the hot-air leads. Branches run to different parts of the fuselage.

The starboard half, or so, of the main vertical panel carries dials which can be observed by the second pilot when he is seated in his sliding seat near the starboard wall of the compartment. The instruments mounted here are: four engine rev indicators; vacuum pump change-over cock; bomb door warning lights; the bomb jettison handle; an altimeter; oxygen supply indicator; wheel brake pressure gauge; and fuel jettison valve.

Engine Controls

Reverting to the equipment for the first pilot, there is a control pedestal approximately in the centre of the compartment which carries at the top the four throttle levers side by side. Below these are, also side by side, the four levers which control the four Rotol airscrews, and below them are the cut-out lever of the automatic boost control, the mixture lever, and the control lever which selects the blower speed. In the "down" position this lever provides medium boost, and in the "up" position full supercharge.

Mention has been made above of the electric repeater compass. In addition, there is a normal magnetic compass, mounted under the instrument board and in front of the joy stick.

Even this list does not exhaust the equipment in the first pilot's compartment. On the port wall are the switches for "cutting-in" and "cutting-out" the automatic pilot, and the radio tuning controls. Next to the first pilot's seat, on his right, are the levers for operating the hydraulic services such as bomb doors, flaps and undercarriage. Placed in that particular position, they are within reach of, and can, if necessary, be worked by, the second pilot.

On the "ground floor," below the pilots, is the radio

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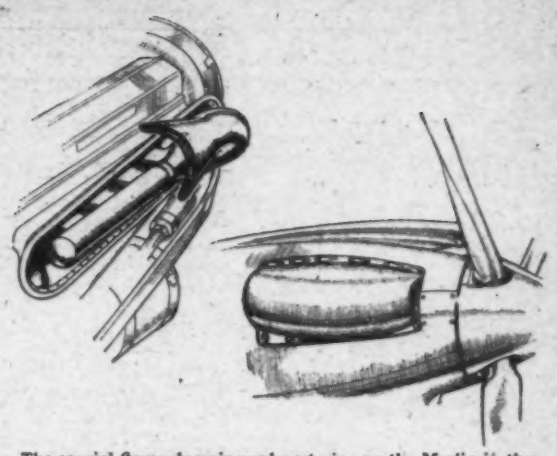
operator's compartment. Here, of course, is installed all the wireless equipment, with the exception of the loop aerial, which is mounted on top of the fuselage farther aft, and is distantly controlled. Of the transmitting and receiving equipment it is, perhaps, better to say nothing. It may or may not be known to the enemy, and there is little point in taking a chance on giving him information. At any rate, our radio equipment is, by common consent, better than the German.

Navigating in Comfort

The navigator's compartment is comparatively comfortably furnished, with a quite large folding chart table at which he can plot his courses and generally work in comfort. The type of parallel-motion equipment familiar from the aircraft draughtsman's board is used in place of the parallel rulers of the sea navigator, and the table is illuminated by a small Terry Anglepoise lamp. In addition to his own outfit, the navigator is also provided with an altimeter, air temperature gauge, and an airspeed indicator.

Proceeding aft, we come to the flight engineer's compartment, which is uncommonly well stocked with dials. Four engines need a lot of surveillance, and the fact that they are out in the wings means that they are out of sight and their well-being can only be ascertained by distantly placed dials. Most of the flight engineer's dials are placed on the after wall of the compartment, which is, as previously mentioned, of armour plate, so that the delicate instruments, as well as the forward crew, are protected against attack from behind. On this wall of the flight engineer's compartment are found fuel tank content gauges (quite an excellent array of them), oil temperature and oil pressure gauges, radiator flap controls, and airscrew anti-icer controls.

Passing aft through the door in the armour-plate bulkhead, we come to a compartment partly used for stowage of all manner of equipment, and partly as a rest station for members of the crew. Between the front and rear wing spars upholstered seats run along both outer walls. The main fuel tank cocks are housed under the seats, and there are also catches for releasing the undercarriages from their "up" position, should the hydraulic system fail. A hand-operated pump is provided, so that in the event of the power supply going wrong the undercarriages can be raised and lowered by man-power. At the forward end of this compartment is the accumulator for the hydraulic system which operates the bomb doors; there also are some of the oxygen bottles which supply the 13 points in the fuselage from which the members of the crew obtain their oxygen by plugging into bayonet sockets.



The special flame damping exhaust pipe on the Merlin in the Halifax is shown on the left. An outer cowling (right) obscures the exhaust flames still more. There is thus little to give away the position of the machine to the night fighters.

The rear end of this compartment is closed by a plywood draught wall, aft of which is a large stowage space for such items as flares, etc. A swinging ladder gives access to the dorsal two-gun turret, which, like those in nose and stern, is of Boulton-Paul design and manufacture. Aft of the ladder are racks for sea markers and ammunition, and here also start the conveyor rails along which ammunition is supplied to the tail gunner.

Aft of here there is a drop in floor level, the floor being directly on the bottom of the fuselage. At this point, on the port side, there is the small door through which the crew enter the machine. Also, as mentioned above, the w.c. is located here, on the port side, and aft of that, elaborately swung in gimbals and isolated from vibration, is the master gyro compass; repeater compasses are located in the pilot's and navigator's compartments.

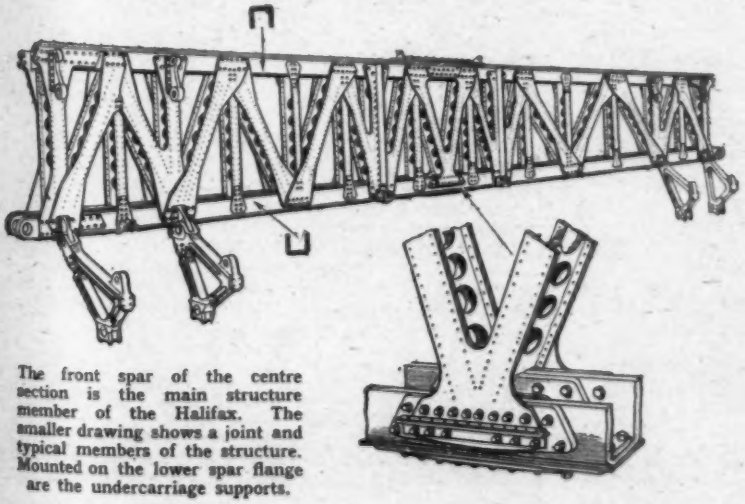
The compartment in the rear end of the fuselage houses a large dome for the retractable tailwheel, and at its rear end gives access to the gun turret in the stern.

The Heating System

That completes our survey of the interior of the Halifax. It should, however, be mentioned that, in addition to the oxygen supply, the comfort of the crew is looked after by a very effective system of heating. The hot air is not, as is usually the case, obtained from muffs around one or more exhaust pipes. Instead there are two special radiators incorporated in the glycol cooling system, one behind and above each of the inboard engines. Air, under control, enters the engine nacelles and is passed through these radiators, where it is heated during its passage, and is then led through flexible tubes of large diameter to the interior of the fuselage. Inside the fuselage the large-diameter pipes branch into smaller pipes, which run to the different compartments.

It might also be mentioned that the flying controls are of the Saunders type described in *Flight* of January 1st, 1942. This type of control serves a dual purpose, since a sliding motion is used for the main controls, such as rudders and elevators, while a rotary motion of the same tubes operates lighter controls, such as tabs.

Housed in the wings is, next to the fuselage, a bomb compartment on each side, and outboard of them are the fuel



The front spar of the centre section is the main structure member of the Halifax. The smaller drawing shows a joint and typical members of the structure. Mounted on the lower spar flange are the undercarriage supports.

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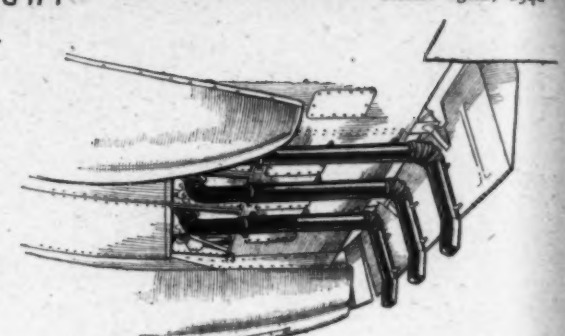
tanks. Some are placed between the main wing spars, and others in the leading-edge in front of the front spar. All tanks are, of course, leak-proofed with rubber. The placing of the tanks is well shown on Mr. Millar's drawing on pp. 398*a* and *b*. Provision is made for jettisoning the fuel in emergency. The pipes (see sketch opposite) lead to the trailing-edge, and a sleeve of rubber on each pipe permits the end of the nozzle to move up and down with the wing flap. The pipes are fairly large and consequently detract somewhat from the appearance of the machine, but that is unavoidable in view of the quantity of fuel that may have to be jettisoned.



Jettison pipe on the Halifax carrying fuel clear of the trailing-edge. To allow the wing flap to deflect a flexible rubber sleeve is used.

Tapering Wings

In plan view the wing shows a fairly pronounced taper, the actual wing chords being 16ft. at the root and 6ft. 6in. at the tip.

The four Rolls-Royce Merlin XX engines are mounted ahead of the leading-edge, the two inboard engines being slightly ahead of the two outboard, so that the airscrews of adjacent engines are not in the same plane.

An interesting point about the engine installation is that great care has been taken over the flame damping of the exhaust. The special exhaust pipes in themselves reduce the amount of visible flame, and the rest is hidden by an exhaust cowl placed over the exhaust pipe.

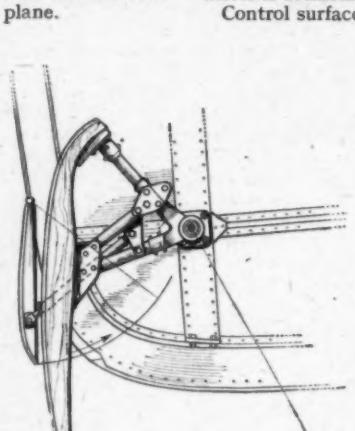
Mounted on the port inboard engine is a Heywood compressor for the pneumatic brake system, and each of the inboard engines drives a 24-volt 1,000 watt electric generator, that on the port engine supplying the lighting system, while the generator on the starboard engine furnishes power for engine-starting, feathering of the Rotol airscrews, etc.

Messier undercarriages carry Dunlop wheels measuring 24in. by 19in. Retraction into the engine nacelles is by the usual "broken" rear strut. Normally the undercarriages are operated by hydraulic power, but a hand pump in the fuselage forms an auxiliary means of operation.

Should the entire hydraulic system fail, through enemy action, for example, pieces of stretched rubber cord assist the operation. Some idea of the size of the Halifax may be formed from the fact that the wheel track is 24ft. 8in.

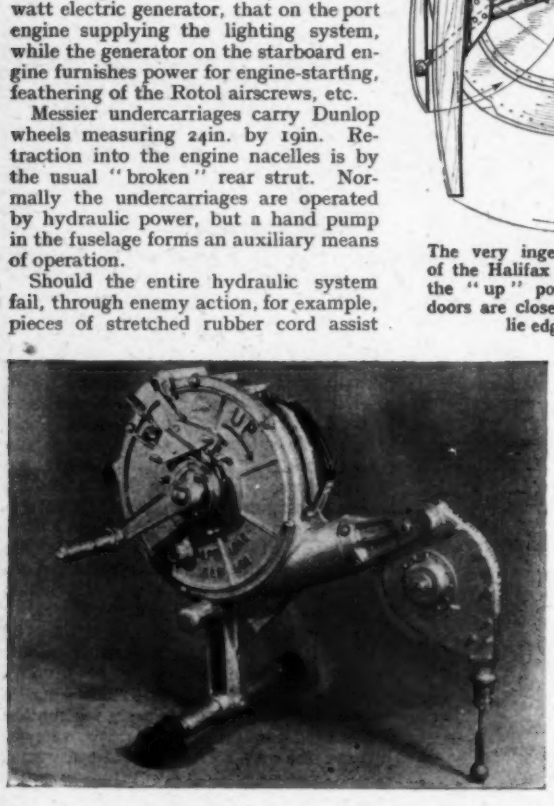
The Dunlop brakes are pneumatically operated. The tail wheel is retractable, but this feature is not always used.

Control surfaces are of normal type, the wing flaps being of the Handley Page patented slotted type, which gives low drag and high lift for take-off when down at a fairly small angle, and high lift and drag for landing when fully down. The tailplane is of the monoplane type, and carries a fin and rudder at each end.



The very ingenious bomb doors of the Halifax are shown here in the "up" position. When the doors are closed the two portions lie edge to edge.

Although it differs from the Hampden in general outline design and, of course, in size, the Halifax has many structural features in common with the earlier machine. The "split" construction is of a somewhat different kind in that the fuselage, for instance, is not split longitudinally for ease of production but is divided laterally. The large size enables several men (or women) to work simultaneously on one section, but the transverse splitting does introduce a certain amount of complication in that electric and hydraulic leads have to be "cut" at the fuselage joints. This means that quick connectors have to be used. In the case of the electric leads this is accomplished by adopting the Breeze system of wiring, with multi-pin connectors.



The Handley Page Gyral bomb winch. This can be placed on the wing or in the fuselage, the bomb weight being taken by the swivel, and the "feet" merely steady the winch.

In the rear portion of the fuselage, where the stresses are not so great, the joints between fuselage portions are of very simple type. The end ring or frame of each portion is reinforced by and riveted to a stiffening ring of extruded L-section. The longer limb of the L, which tapers towards its free edge, is riveted to the skin, while the shorter limb, which is a good deal thicker, is riveted to the normal frame, and also has holes in it for the numerous small bolts by which it is attached to the corresponding ring of the next fuselage section. Where greater stresses are encountered, such as, for example, where the fuselage bomb bay is attached to the floor, special forgings are used to reinforce the connection.

The normal main frames of the fuselage are of built-up box section, with the flanges turned outwards for ease of riveting, and with an internal channel section for stiffening. The intermediate frames are of Z-section, formed from sheet. The frames are notched for the stringers, which are of "figure-two" section.

In the structure of the wing, the front spar of the centre-section forms the backbone. It is a veritable bridge girder, with very thick extruded channel sections for flanges, and vertical and diagonal struts for tie members. These latter are of a form generally similar to the fuselage frames (that is to say, box-sections with outwardly

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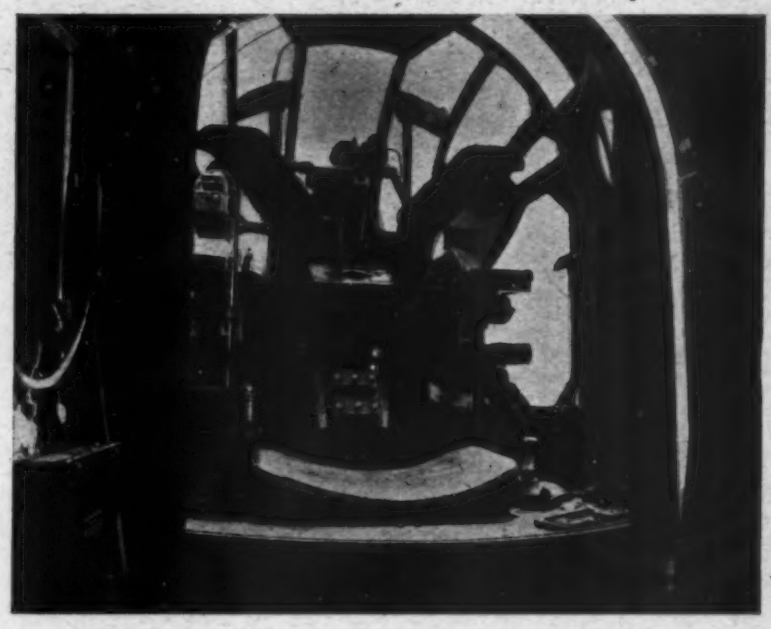
This three-quarter rear view of the Halifax shows an earlier production and was taken before a dorsal gun turret was fitted.

turned flanges), but the material of the boxes, especially the flat front and rear plates, is many times thicker, as the loads in this neighbourhood are very large. The general construction of the centre-section front spar is shown by a sketch.

The centre-section rear spar is of different construction, with extruded T-section flanges and solid sheet web. A similar construction is employed for both front and rear spars in the outer wing portions, but the flange sections change from T to L. The wing ribs in the centre-section carry heavy loads and have solid sheet webs riveted between two L-section flanges placed back to back.

The rib webs are stiffened by vertical channel sections, one on each side of the web for the main stiffeners and on channel on one side for the intermediate stiffeners.

The trailing-edge ribs are of slightly different construction. The main ribs have channel-section flanges placed with the open side towards the skin. Instead of the solid sheet web of the between spar ribs, the top and bottom channels are connected by diagonal tubes, attached to the flange channel sides by fishplates. The spanwise stringers of the wing skin are cut at their intersection with the rib flanges.



The sting in the tail. The gunner's turret with its four Browning machine guns.

Unit Construction

In the construction of the wing, as in that of the fuselage, small assemblies are formed into larger ones, and finally into quite large units, so that the work of assembly permits the greatest possible number of workers to be employed simultaneously. The actual production methods in force in the Handley Page works, which are very interesting, will be dealt with in detail in our associated journal *Aircraft Production*.

An ingenious system has been evolved for transporting the large wing and fuselage portions from the manufacturing to the assembly shops, which are situated elsewhere. The wing centre-section, for example, is transported in a vertical position, with the engine mountings and bulkheads already in place, and the fuselage top (known as "the covered wagon") already attached.

The general construction and internal layout are shown in the large drawing by Mr. M. A. Millar on page 398*a* and *b*. The system of breaking down the structure into a number of units is illustrated diagrammatically on page 399. The main dimensions of the Halifax are: Wing span 99ft.; wing area 1,250 sq. ft.; length o.a. 70ft. 11in.; fuselage width (max.) 5ft. 6in.; fuselage height (max.) 9ft. 6in. Detailed performance figures may not be given, but the maximum speed is in the neighbourhood of 300 m.p.h. Maximum range is about 3,000 miles, and maximum bomb load 5½ tons. The two do not, of course, occur simultaneously.

The four Rolls-Royce Merlin XX engines develop 1,175 h.p. each, at 20,500ft., and drive Rotol three-bladed, constant-speed, fully feathering airscrews of 12ft. 6in. diameter.

Take-off and landing characteristics are very good, in spite of a wing loading of 47 lb./sq. ft.

Readers who would like to compare the Halifax with the Short Stirling heavy bomber are referred to our issue of January 29th, 1942, in which we published a long illustrated description of that machine.

HERE AND THERE

Industrial Brains Trust

MEETINGS which have proved helpful in clearing up numerous problems and so aiding the industry in its war effort, are periodically held by members of the Sheet Metal Industries Association.

At these meetings, a "brains trust," composed of production engineers, technical consultants, business managers and accountants, are present to answer questions from the body of the hall; the association was formed last September and is steadily growing in membership.

Its present activities mainly concern the collection of data for the efficient utilisation of the industry's capacity and the provision of direct contacts between members and the supply Ministries.

To Cleaning Uniforms—£?

THE Accounting Officer at a certain West Country R.A.F. station was recently faced with a bill for the cleaning of several hundred uniforms.

Those uniforms needed cleaning because they had been worn by some of the 1,000 officers, aircrews and ground staff who had saved a Coastal Command aircraft from the incoming tide when it had forced-landed on a sand bank in a river estuary. Every available man on the station had been quickly mustered to drag the aircraft to safety, and as the ropes sometimes broke the straining airmen invariably sprawled in the mud.

But the inch-by-inch tug-of-war was won in the nick of time and a £25,000 machine was saved at the cost of a dry-cleaner's bill.

Canada's Mounting Production

CANADA is now producing sixteen twin-engined Bristol Bolingbroke and 100 twin-engined Avro Anson trainer-bombers monthly, according to a statement in Toronto by Ralph P. Bell, director-general of aircraft production. Canada is also shortly to start making aircraft engines for Fairchild trainers. The Ranger engine is to be produced at Ontario plants of the Chrysler Corporation, and a production quota of 300 monthly has been set.

In the thirty months which Canada has been at war the Canadian aircraft industry has increased its employees from 1,000 to 40,000, and aircraft production from forty annually to ten daily. Every Canadian plant is booked solid until at least December 31st, 1943, and some into 1944 and 1945.

The largest plant is nearing completion at Malton, near Toronto, with 750,000 square feet of floor area.

Dangerous Low Turns

ACCORDING to a recent report issued by the Safety Bureau of the Civil Aeronautics Board of America, instructors of civilian student pilots do not seem to have been impressing upon their pupils with sufficient emphasis the latent perils of low-altitude turns.

Examination of a group of twenty flying accidents involving light aircraft pilots of limited experience, showed that nine resulted from turns during the landing approach and three from stalls during the first turn after take-off. None of the cases, incidentally, involved a student of the Civilian Pilot Training Plan, but one was caused by the pilot trying to turn back when his engine failed just after take-off.

There is, of course, no civilian flying instruction taking place in this country to-day, but it is safe to say that in pre-war club days every learner-pilot in this country had instilled into him, before he was allowed to go solo, the danger of low altitude turns, especially climbing turns, with the result that accidents of this kind were very rare indeed.

There is a natural tendency to hold the nose up when making a low gliding turn with the obvious risk of stalling the inside wing, while if the engine fails during a climbing turn only the promptest action will avert a spin.

ALEX. TAKES A BOW: King Haakon congratulates Test-pilot Alex. Henshaw after watching his display in a Spitfire during his visit to a Midland aircraft factory recently. Norway's king has been making a tour of Britain's war industries.

Much Better

READERS of *Flight*, who will have shared our sympathy with Mr. Richard Fairey, Jun., whose legs had to be amputated below the knee after being torpedoed in mid-Atlantic, will be pleased to know that he is making a good recovery and says he is now "feeling very much better."

As was reported in the daily Press, he was on his way to visit his father, Mr. C. R. Fairey, who is serving on the British Air Commission in America, when the cargo boat in which he was travelling was sunk by a U-boat after losing the convoy. He and other survivors suffered six days in an open boat before being spotted by a Hudson and later picked up by an American destroyer and his legs were severely frostbitten.

Richard Fairey, who was a well-known figure in civil aviation before the war, had been engaged on Atlantic Ferry work, and, with at least two precedents in the way of legless pilots before him, he is not likely to let his loss keep him on the ground for very long.

Air Training Charts

DURING a recent visit to a R.A.F. air crew receiving centre in England, Sir Archibald Sinclair, Secretary of State for Air, was shown a room the walls of which were covered with large charts decorated with little flags of many colours and shapes. The Secretary of State must have wondered at first what new battlefield he was being called upon to take into account.

Actually, this remarkable series of charts, designed and supervised by a squadron leader, gives a complete and up-to-date bird's-eye view of the whole complex procedure of flying training in this country. Intake and current strength of the Initial Training Wings, and of the various schools of instruction for pilots, navigators and air gunners are all set out diagrammatically.

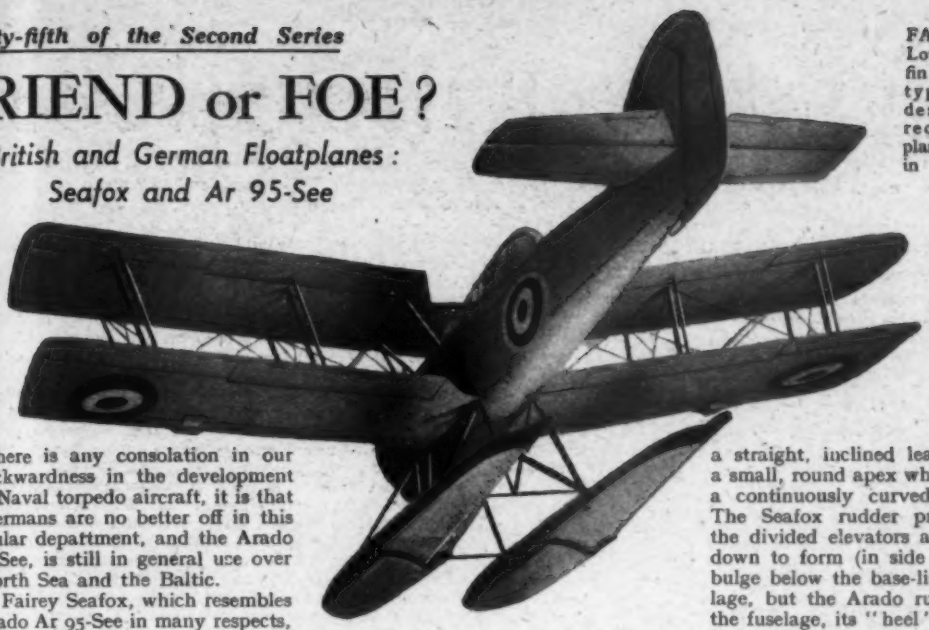
Here Sir Archibald was able to see at a glance the progress of Britain's air crews of to-morrow.

"THE PATIENT HAD A HOT BATH." Removing an airscrew blade after annealing it. The blade had been bent in a crash, and has been straightened by men of Maintenance Command.

Thirty-fifth of the Second Series

FRIEND or FOE?

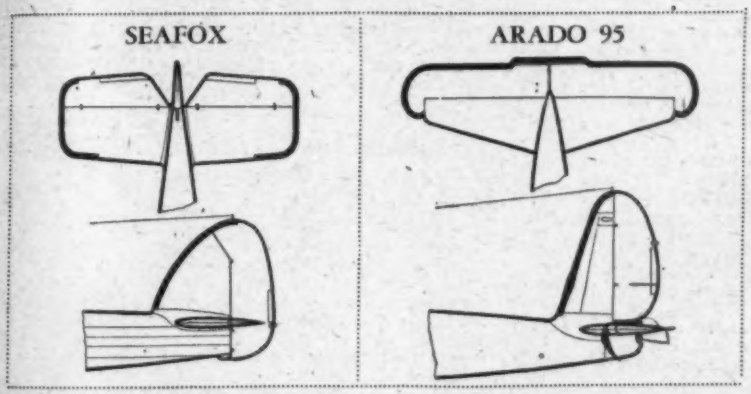
British and German Floatplanes: Seafox and Ar 95-See



FAIREY SEAFOX: Low aspect-ratio fin and rudder of typically Fairey design. Almost rectangular tailplane with "bite" in trailing-edge.

IF there is any consolation in our backwardness in the development of Naval torpedo aircraft, it is that the Germans are no better off in this particular depattment, and the Arado Ar 95-See, is still in general use over the North Sea and the Baltic.

The Fairey Seafox, which resembles the Arado Ar 95-See in many respects, is a two-seater reconnaissance catapult aircraft and was first delivered to cruisers in 1938. It was a Seafox which was largely responsible for the defeat of the *Graf Spee* by its fine work in spotting for the guns.

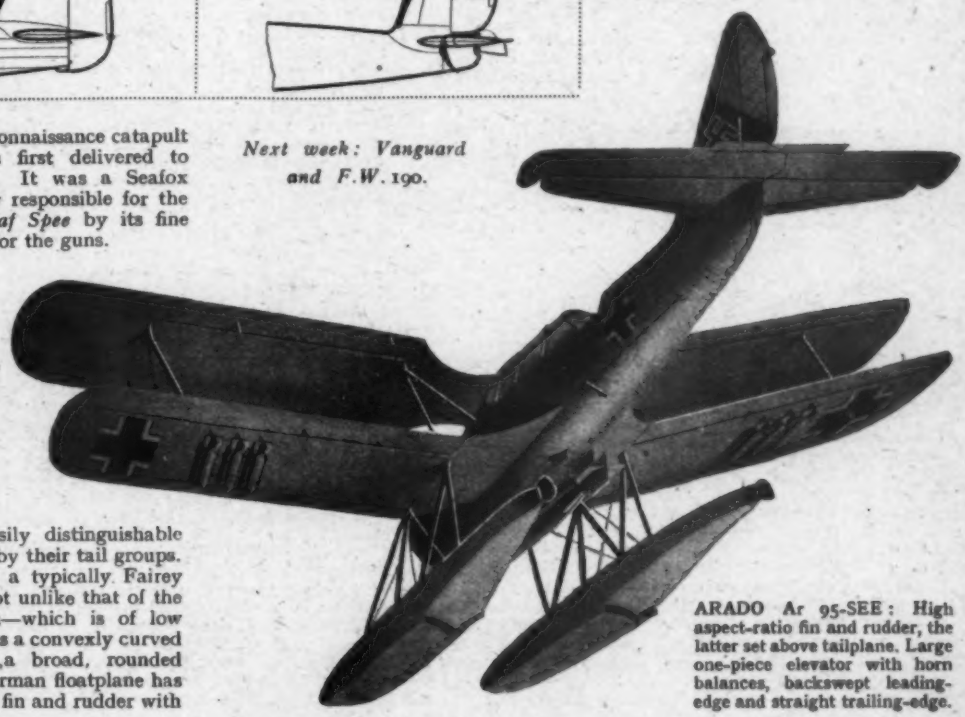


Although the Arado has a radial engine and the Seafox an "H"-shaped Napier Rapier engine, the two aircraft closely resemble each other in wing plan and general dimensions, but are easily distinguishable from a stern view by their tail groups.

The Seafox has a typically Fairey fin and rudder—not unlike that of the familiar Swordfish—which is of low aspect-ratio and has a convexly curved leading-edge and a broad, rounded apex, while the German floatplane has a high aspect-ratio fin and rudder with a straight, inclined leading-edge and a small, round apex which blends into a continuously curved trailing-edge. The Seafox rudder projects beyond the divided elevators and comes well down to form (in side view) a slight bulge below the base-line of the fuselage, but the Arado rudder sits atop the fuselage, its "heel" curving in to the base of the fin on top of the tailplane. The Arado elevator is a one-piece surface projecting well astern of both rudder and fuselage.

In plan, the Seafox tailplane has a slight taper to both edges and flat tips with slightly rounded corners, its elevators having a V-shaped "bite" for rudder clearance. The tailplane of the Arado, which is of high aspect-ratio, has a backswept leading-edge with projecting horn balances to its large area elevator, and a perfectly straight trailing-edge.

Next week: Vanguard and F.W. 190.



ARADO Ar 95-SEE: High aspect-ratio fin and rudder, the latter set above tailplane. Large one-piece elevator with horn balances, backswept leading-edge and straight trailing-edge.

Correspondence

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

RANGE AND FUEL ECONOMY

Power Coefficient Formulae

THE right remarks of Mr. W. E. Hick in your issue of February 26th on the subject of an erroneous use of $L^{3/2}/D$ as a power coefficient instead of $C_L^{3/2}/C_D$ can be explained in the following simpler way:—

$C_L^{3/2}/C_D$ is the number (no units), whilst

$$L^{3/2}/D = \left[\frac{lbs^{3/2}}{lbs}\right] = \left[lbs\right]^{1/2}$$

is measured in units and it cannot be equal to the former.

On the other hand, the coefficients C_L/C_D and L/D

$$= \left[\frac{lbs}{lbs}\right] = \left[0\right]$$

are both numbers and they express the same thing.

W. JAWORSKI.

ARMY SQUARE PEGS

Disappointment Leads to Apathy

ON the subject of Army transfers to the R.A.F., I would like to bring my own case to your notice.

I was in the first age group to be affected by the "peace-time" Militia scheme and I asked for service with the R.A.F., but was informed that there were no vacancies, and regardless of any qualifications I may have I was posted to an infantry unit. This I did not mind, for I considered that six months' infantry training would be beneficial—and I still hold that view.

However, the war came, and I was sent abroad; but when, some time after my return, I learned that the R.A.F. were asking for men from the Army, I immediately applied and was accepted by the A.C.S.B. some eight months ago. Like "Private" (in your issue of April 9th) I spent several months improving my knowledge of subjects akin to flying, and, pending transfer, my unit was at loss as to what to do with me, until finally they gave it up and left me alone, kicking my heels all day long.

But since the news came that the War Office have changed their minds, I have been returned to duty with a feeling of acute disappointment. Is it not understandable, then, that I go about my present duties with apathy and complete lack of enthusiasm?

There is, however, just one spark of hope which I think "Private" should note: the wording of the A.C.I. is that transfers are *suspended*—not cancelled. There is a difference.

I wish the position could be clarified, for after years of intense enthusiasm for flying, and the prospect of my ambitions within my grasp, I feel very keenly the effect of this countermanding Army Order.

"SQUADDIE."

HOME GUARD AIR ARM

America Already Has One

MANY middle-aged men who held "A" licences before the present war and possibly many who were pilots in the last war will surely have been interested to read, in *Flight* of April 16th, the letter from "1926 'A' Licence," suggesting the formation of an Air Arm in the Home Guard.

It must be remembered, of course, that the ill-fated Civil Air Guard, which might have served much the same purpose had it been properly handled, came into being long before the Home Guard was even thought of, so it will be no answer to say that the idea has been tried once and failed.

America already has a Civil Air Patrol, sponsored by Mayor La Guardia, composed in part of already licensed pilots augmented by a similar number of student pilots (*vide Flight*, April 2nd), and the great value of light aircraft for internal communications was so conclusively proved in the U.S. Army manœuvres just before the Japs struck that the type has, I understand, been adopted by their air forces in large numbers.

Should invasion of this country be attempted at all it is only too likely that the enemy will launch air attacks at a number of points simultaneously and that one of his activities will be to employ parachutists and other airborne troops to disrupt our telephone and telegraph services. In this event, the value of light aircraft as aerial "despatch riders" and aerial "staff cars" needs no stressing. It seems more than probable, however, that our regular Army Co-operation Squadrons will have their hands full, so if the Home Guard were to have its own Air Arm for rapid communication between its various areas of operations, it would certainly be all to the good.

But if the scheme is to be of any real practical use, it must be got going *at once*, so that "A" pilots who have become rusty through inaction may have a sporting chance to brush up their flying and navigation.

There must be many in their middle forties who, like myself, became reasonably competent in handling such types as the Tiger Moth, Miles Maggie, Taylorcraft and so forth, and who, at a pinch, could side-slip a flapless Moth into a fairly small field, but who have not flown since the summer of 1939. I should be among the first to join the Home Guard Air Arm if and when it is formed, but I realise only too well that I should need a bit of practice, not to mention a refresher course in elementary navigation, before I should be anything but a perilous liability.

The need is self-evident and its urgency equally obvious. Will it be met without delay or shall we, as usual so far, find ourselves inadequately prepared if and when the call comes?

"1935 AMATEUR PILOT."

RECRUITING FERRY PILOTS

American Women in the A.T.A.

A NUMBER of men and women with very limited flying experience have written to me complaining that they can get no response from the authorities to their appeal to be recruited for service as Ferry Pilots in the Air Transport Auxiliary. Most of my correspondents complain that fantastic salaries are being paid to American women pilots recently appointed to the A.T.A., to which references have been made in the Press.

In view of the agitation on this matter I have consulted the Minister of Aircraft Production. It occurs to me that your Journal is a suitable medium for letting all enthusiastic Ferry Pilot aspirants know what I have been told. Of many thousands of applications received from pilots, with the standard of experience demanded by the authorities, a large number have received appointments; there is only a further 350 awaiting testing.

The original qualification was substantial flying experience but this has now been modified to the extent that the Ministry of Aircraft Production is at the present time taking on British men and women with 50 flying hours or, in some cases, slightly less experience.

As regards the American women pilots engaged, or to be engaged, under the scheme, I understand that their number will be no more than a couple of dozen. All will have had considerable flying experience and most of them are already familiar with the handling of twin-engined aircraft. They will need no training in the accepted sense of the term but will, of course, be taught the handling characteristics of operational types and made familiar with the ferry routes, wartime obstructions, etc. We should welcome these women, not only for the skill and experience they bring with them, but also as a further indication that our allies in the United States are determined to take a share with us in every phase of the war effort.

As all available British sources of recruits possessing the required qualifications are not yet by any means exhausted, it is not contemplated that a training establishment shall be set up in the near fuure to train members of the Civil Air Guard, and others with some small flying experience, as pilots for the A.T.A. Whether it will be necessary to resort to such training later must depend upon factors connected with the war which it is at present impossible to forecast.

Wing Commander A. W. H. JAMES, M.C., M.P.

Service Aviation

Royal Air Force and Fleet Air Arm News and Announcements

Awards

THE KING has been graciously pleased to approve the following awards in recognition of gallantry displayed in flying operations against the enemy :—

DISTINGUISHED FLYING CROSS.

Flt. Lt. W. E. COLES, 216 Sqn.—On November 29th, 1941, this officer was the captain of one of three aircraft which carried important personnel from advanced air headquarters to Tobruk. The area was surrounded by enemy ground forces. When Flt. Lt. Coles arrived in the vicinity of Tobruk an enemy bombing raid was in progress. The whole of the defences were firing, but Flt. Lt. Coles, realising the importance of his mission, courageously flew through the defences and made a safe landing. Enemy aircraft, whose pilots had observed the illuminated flare path, attempted to destroy his aircraft on the ground, but, having accomplished his mission, Flt. Lt. Coles took off in the dark and flew back to base, thus saving his aircraft. Throughout he displayed great courage and determination.

Flt. Lt. G. F. MORLEY-MOWER, No. 451 Sqn.—This officer's sorties have included tactical, photographic and artillery reconnaissances and flights as protecting cover to other pilots. His artillery reconnaissances have frequently been highly praised by the Army formations with which he was co-operating. In particular, his reconnaissance work immediately before the fall of Bardia was outstandingly good. Flt. Lt. Morley-Mower has shown complete disregard of his personal safety, and his unfailing keenness, enthusiasm and cheerfulness have set an excellent example.

Flt. Lt. D. F. WESTENRA, R.A.F.V.R., No. 112 Sqn.—This officer took part in the campaigns in Greece and Crete. On one occasion, in Greece, when 15 enemy aircraft were diving to attack the

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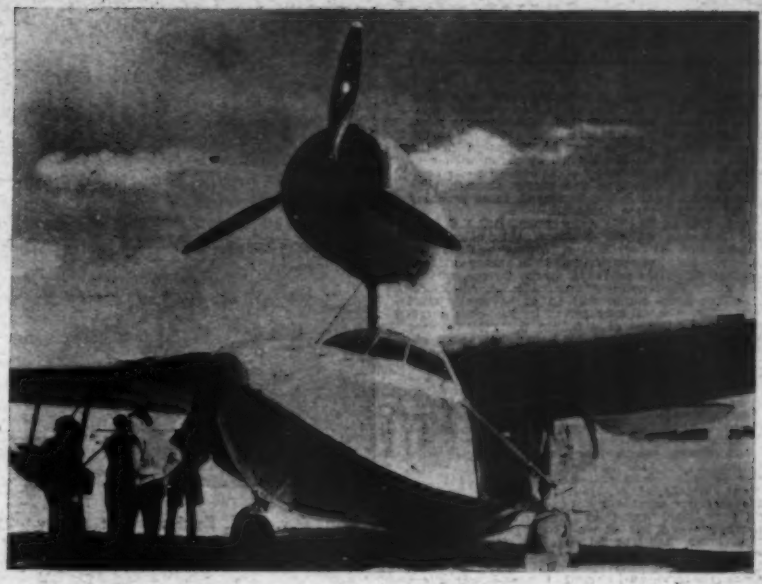

Fairchild 91 amphibians are being used in the Middle East for air/sea rescue work. It is a six-seater (including crew) with a cruising range of 700 miles. The engine can be either a Pratt and Whitney Hornet or Wright Cyclone of 750 h.p.

THE WAR OVER THE SEA : The senior officers of Coastal Command Groups which operate as far apart as Gibraltar and Iceland recently met in conference with their Commander-in-Chief. (Left to right) Air Vice-Marshal B. B. A. Baker, C.B., M.C., Air Commodore W. H. Primrose, C.B.E., D.F.C., Air Vice-Marshal J. M. Robb, C.B., D.S.O., D.F.C., A.F.C., Air Vice-Marshal A. Durston, A.F.C., Air Commodore S. P. Simpson, C.B.E., M.C., Air Chief Marshal Sir Philip Joubert de la Ferte, K.C.B., C.M.G., D.S.O., Commander-in-Chief ; Air Vice-Marshal G. R. Bromet, C.B.E., D.S.O., Air Commodore I. T. Lloyd, C.B.E., and Air Commodore H. G. Smart, C.B.E., D.F.C., A.F.C.

SERVICE

airfield, he took off in company with two other pilots and drove the raiders off. On another occasion, in Crete, he intercepted, with another pilot, a formation of 12 Messerschmitt 110's, destroying one of them. In the present campaign in the Western Desert he has led his squadron with conspicuous ability on many occasions. In one combat alone he destroyed two enemy aircraft, thus bringing his total to five destroyed, three probably destroyed and three damaged.

Act. Flt. Lt. R. W. ALEXANDER, R.C.A.F., No. 148 Sqn.—As an air observer, this officer has carried out 51 operational sorties against the enemy. He has participated in many attacks against objectives in Libya, Syria, Greece, and in the whole Mediterranean area. Flt. Lt. Alexander is a fine bomb aimer and an exceptionally good navigator. Over a long period he has been carrying out the duties of squadron navigation officer with great success, and his experience as an observer, combined with his ability as an instructor, have enabled him to attain a very high standard of navigation in the squadron. This officer has displayed consistent keenness, coolness and determination and has set a fine example to all.

Act. Flt. Lt. M. L. P. BARTLETT, No. 282 Sqn. (since deceased).—This officer recently carried out a series of very successful low flying attacks over Libya during which many enemy aircraft were destroyed. Flt. Lt. Bartlett's courage and devotion to duty set an extremely high standard.

Act. Flt. Lt. C. W. HARPER, No. 113 Sqn.—For the past five months this officer has been engaged on operational flying in Blenheim aircraft and throughout he has shown the utmost determination. He has carried out several long and dangerous low level bombing and machine-gunning attacks, some of them at night. On one occasion, despite intense anti-aircraft fire and searchlight activity, he made four runs over Benghazi harbour at a height of 20 feet in a determined attempt to bomb an enemy ship. His keenness and courage have proved a source of inspiration.

Act. Flt. Lt. T. L. HOGG, No. 11 Sqn.—This officer has carried out 42 operational sorties against the enemy in Greece, Syria, Iraq, Iran and Libya. He has shown great qualities of courage, determination and leadership.

Act. Flt. Lt. G. B. JOHNS, No. 239 Sqn.—This officer has been employed on operational flying since the beginning of the war and has carried out 250 sorties against the enemy. He took part in the operations over Dunkirk and in the Battle of Britain. In the Western Desert, he has carried out many reconnaissances and attacks on enemy ground targets far behind their lines. Flt. Lt. Johns has destroyed two enemy aircraft (one of which was shot down at night), probably destroyed two and damaged several others. He has displayed great skill as a pilot and has frequently led the squadron in action.

Act. Flt. Lt. G. W. MILSON, R.A.F.V.R., No. 84 Sqn.—This officer has carried out 56 operational sorties against the enemy in Europe and in the Western Desert. Flt. Lt. Milson's keenness, energy and ability are exceptional and he is considered one of the most outstanding officers in the squadron. His cheerfulness and initiative in all circumstances have done much to maintain a very high standard of morale.

Act. Flt. Lt. R. M. RECHNER, R.A.A.F., No. 11 Sqn.—This officer has filled the post of deputy flight commander in the present campaign in the Western Desert, and has shown great qualities of leadership. Flt. Lt. Rechner has continuously displayed great keenness and determination.

Wing Cdr. J. K. Buchanan, of No. 37 Squadron, who has been awarded a Bar to his D.F.C.

Act. Flt. Lt. S. STOREY, R.A.F.V.R., No. 104 Sqn.—This officer has set a very high standard during the 78 operational sorties he has carried out against the enemy. Many of these were undertaken as an air gunner in France, where he destroyed four enemy aircraft. After the fall of France, Flt. Lt. Storey completed 26 night bombing sorties as a tail gunner, including attacks on Berlin, Pilsen, Dresden and three missions to Italy.

This officer has completed further sorties in the Middle East. On one occasion when carrying out an attack on Naples his aircraft was attacked by an enemy night fighter, but Flt. Lt. Storey drove it off by his accurate fire; his coolness and skill undoubtedly saved the aircraft and crew. This officer's courage and coolness in the face of great danger have proved an inspiration to all.

Capt. A. C. BOSMAN, S.A.A.F., No. 4 (S.A.A.F.) Sqn.—This officer has led the squadron in many attacks on enemy ground targets and has displayed complete indifference to his personal danger. Capt. Bosman has destroyed six enemy aircraft, shared in the destruction of one, and damaged several others. On one occasion he led the squadron in a most determined and successful attack on an enemy column west of Mechili although the enemy's fire was concentrated on him. He has continuously displayed the greatest courage and keenness.

Capt. L. H. G. SHUTTLEWORTH, S.A.A.F. (No. 41 (S.A.A.F.) Sqn.—This officer has carried out 82 sorties against the enemy, during many of which he has acted as leader. His excellent reports and accurate bombing, together with his qualities of leadership and devotion to duty, make him an outstanding Army Co-operation pilot.

Capt. A. L. THRACKWRAY, S.A.A.F., No. 31 (S.A.A.F.) Sqn.—During his 50 operational flights this officer has proved himself to be an outstanding bomber pilot with great qualities of leadership. One day in December, 1941, whilst on patrol over the Derna area, Capt. Thrackwray intercepted four Junkers 52's. He shot down one enemy aircraft in flames and, by skilful manœuvring, enabled his rear gunner to destroy another. He then continued to attack the remaining two enemy aircraft which he succeeded in damaging. This officer's work as a flight commander has been of the highest standard, and he has displayed great skill, determination and devotion to duty.

F/O. A. H. BURTON, R.A.F.V.R., No. 70 Sqn.—This officer has carried out a total of 55 sorties against the enemy. He always plans his attacks most carefully and places his bombs to the very best advantage. He never misses an opportunity to machine gun the enemy from a low altitude, and the results of his attacks have been consistently good. F/O. Burton has always displayed the greatest keenness.

F/O. N. L. R. COWAN, No. 148 sqn.—This officer has carried out 42 operational sorties against objectives in Germany, Libya, and targets in the Mediterranean area. He has carried out 13 attacks on Benghazi. On one occasion he succeeded in bringing his aircraft safely back to base although one engine failed. F/O. Cowan has at all times shown great keenness and efficiency and complete disregard of enemy opposition.

F/O. A. P. CRANSWICK, No. 148 Sqn.—This officer has carried out 61 sorties over Germany and enemy occupied territory, against Italian targets and in the Mediterranean. Throughout he has proved himself a most capable captain, whose determination to complete his task, often under difficult conditions, has been exceptional. He has excelled in the training of new crews in whom he has instilled the greatest confidence.

F/O. G. D. GREEN, R.A.F.V.R., No. 140 Sqn.—F/O. Green has always shown the greatest courage and determination in carrying out his duties in the face of enemy opposition.

F/O. D. H. HAMMOND, R.N.Z.A.F., No. 272 Sqn.—Returning from an operation in Libya, this officer observed another aircraft of his squadron which had crash-landed in enemy territory. He attempted to land, but damaged his aircraft in the operation. In spite of this he made a second attempt and eventually succeeded in rescuing the two members of the crew. After destroying the crashed aircraft with gunfire he returned safely to his base. F/O. Hammond has consistently displayed a high standard of keenness and courage.

F/O. J. A. JARVIS, No. 30 Sqn.—Since Italy entered the war, this officer has carried out 130 sorties against the enemy. These include bombing operations, day and night fighting and low level attacks on enemy ground targets in Greece. F/O. Jarvis has destroyed two enemy aircraft and has displayed great keenness and reliability.

F/O. J. G. OWEN, R.A.F.V.R., No. 37 Sqn.—This officer has taken part in many long distance operational flights, including raids on objectives in

AVIATION

A group of pupils at an Air Gunners' School of Training Command. The Defiant in the background is one of the types used for training.

SERVICE AVIATION

occupied France, Greece, Crete, Cyrenaica, Syria, and the Dodecanese. F/O. Owen has proved himself to be a most reliable and efficient captain of aircraft. He has displayed great skill as a pilot, and his courage and devotion to duty have set a fine example.

F/O. G. R. WHITTARD, R.A.F.V.R., No. 14 Sqn.—This officer has acted as leading bomb aimer on many occasions when large formations of aircraft were involved. Amongst several outstanding examples of his skill is one particularly brilliant attack on dispersed aircraft on Malemo airfield. Photographs of the results have since been widely published. The keen competitive spirit which exists amongst the observers of the squadron is largely due to his ability and enthusiasm.

F/O. D. S. F. WINSLAND, R.A.F.V.R., No. 33 Sqn.—This officer has carried out 101 operational flights. Following a period of service in England he served throughout the campaign in Greece. F/O. Winsland also participated in operations in Crete, covering the evacuation at Suda Bay. In the Libyan campaign he has shown great determination, especially in very successful forward operations in which the squadron achieved much success against enemy airfields and transports; a large number of aircraft were destroyed on the ground and 300-400 enemy vehicles damaged or destroyed. During this period F/O. Winsland participated in many air combats and he has destroyed three and damaged a further five enemy aircraft.

Sub. Lt. P. N. CHARLTON, R.N., R.N. Fighter Sqn.—This officer has participated in operational flying over a long period. In May, 1940, flying in Skua aircraft, he attacked two oil tankers, scoring a direct hit on one and a probable hit on the other. He also took part in numerous engagements against enemy aircraft off Namsos, Narvik, and over the North Sea, and assisted in the destruction of two Heinkel 111's and a Dornier 26. He has carried out many successful attacks in the Middle East; on one occasion at Bir El Gubi he attacked four Junkers 87's and shot down three of them. Throughout, this officer has displayed great skill and determination. On two occasions he has been forced to descend on the sea, and on the first occasion he spent some eight hours in a dinghy before being rescued.

DISTINGUISHED FLYING MEDAL.

Flt. Sgt. B. EVANS, R.A.F.V.R., No. 108 Sqn.—As an air gunner, this airman has taken part in 48 operational sorties against the enemy. Flt. Sgt. Evans carried out six of these sorties during daylight against advanced enemy positions in France, in the face of fighter opposition. He has participated in the operations in Greece and, in Iraq, has carried out low-level daylight attacks on enemy ground personnel with great success.

Since resuming operations in Libya, this airman has carried out many attacks on Benghazi in the face of intense enemy fire. In September, 1941, when making low-level attacks on enemy roads in the Benghazi area, Flt. Sgt. Evans set on fire a large number of enemy transport vehicles. His qualities of leadership have been an inspiration both in the air and on the ground.

Flt. Sgt. W. A. FISHER, No. 216 Sqn.—In the autumn of 1941 this airman was the captain of one of three aircraft which carried important personnel from advanced air headquarters to Tobruk. When Sgt. Fisher arrived in the vicinity of Tobruk a German bombing raid was in progress and the whole of the Tobruk defences were firing. Despite this, Sgt. Fisher, with grim determination, flew through the barrage and landed safely. The enemy, who had observed the illuminated flare path, attempted to destroy his aircraft on the ground. In order to save his aircraft, Sgt. Fisher decided to fly back. He thereupon took off in the dark and finally returned safely to his base. Throughout he displayed great courage and devotion to duty.

Flt. Sgt. G. E. HARRIS, R.A.F.V.R., No. 37 Sqn.—This airman has carried out 39 operations against the enemy in Germany, France, Holland, Greece, Crete, Syria, Cyrenaica and the Dodecanese. When intensive activity in Libya began he had been taken off operations and was awaiting disposal, but at once volunteered to resume operations. He has invariably set a high standard of courage, determination and devotion to duty and sets a splendid example to all the members of the squadron.

Flt. Sgt. R. JONES, No. 8 Sqn.—This airman has carried out 88 operational sorties against the enemy in Somaliland, Abyssinia and the Western Desert. He has led his squadron on numerous occasions and his efficiency, coolness and courage have set an excellent example.

Flt. Sgt. R. F. SOMERVILLE, No. 84 Sqn.—This airman has been employed on operational flying in many theatres of war in the Middle East since September, 1940. He has continuously displayed great skill and success as a navigator, combined with coolness and courage in the face of the enemy. After a narrow escape from death in Greece, when his aircraft crashed with a full bomb load, and the pilot was killed, Sgt. Somerville returned to his duties after a few days, with the same enthusiasm and efficiency.

Flt. Sgt. G. W. H. WARE, No. 11 Sqn.—As a wireless operator/air gunner this airman has taken part in 60 operational sorties against targets in Abyssinia, Greece, Syria, Italy and the Western Desert. He has always carried out his duties in a most cheerful and efficient manner and his experience and example have been of great value to the rest of the squadron.

Flt. Sgt. J. W. WINSHIP, No. 11 Sqn.—This airman has for the past year acted as senior wireless operator/air gunner in his squadron and has carried out a total of 80 operational sorties against the enemy. He has taken part in the campaigns in Abyssinia, Greece, Iraq, Syria, and the Western Desert. Flt. Sgt. Winship has always done his work with quiet efficiency and coolness, and his keenness has done much to encourage and improve the efficiency of other members of the squadron.

With an eye to possibilities "Buss," a mascot of an R.A.A.F. Squadron in Libya, sees his master off on a Tomahawk.

Sgt. F. J. F. ADAMS, R.A.F.V.R., No. 148 Sqn.—This airman has carried out 53 operational sorties against the enemy, against Germany and German-occupied Europe and in the Middle East. As an observer, Sgt. Adams took part in the Abyssinian campaign and he has operated most successfully against targets in the Eastern Mediterranean. This airman was selected as the observer of a specially chosen crew which was detailed to drop pamphlets over a very wide area in Crete and Greece, and he carried out his task most successfully. He has at all times displayed the greatest keenness for operational flying, as well as determination to destroy the allotted target. He has set a fine example.

Sgt. F. BRIERLY, R.A.F.V.R., No. 55 Sqn.

Sgt. C. CONNER, R.A.F.V.R., No. 55 Sqn.

As pilot and wireless operator-air gunner respectively Sgts. Brierly and Conner have taken part in numerous operational sorties against the enemy. On several occasions Sgt. Brierly has led the squadron, displaying leadership of a high order. As a crew, these airmen have set a splendid example of efficiency, courage and determination. Sgt. Brierly's operational sorties total 58 and those of Sgt. Conner 79.

Sgt. A. E. CHAPLIN, No. 18 Sqn.—This airman has carried out a total of 97 operational flights against the enemy over Germany and in the Middle East. His skill as a bomb aimer is exceptional, and on many occasions when holding the responsible post of leading observer in a large formation of aircraft he has acquitted himself admirably. Sgt. Chaplin has shown the greatest keenness and courage.

Sgt. K. V. COX, R.A.F.V.R., No. 11 Sqn.—This airman has carried out 36 operations against the enemy in Libya, Greece, Iraq, Syria and Iran. As an observer, he has displayed great keenness, and devotion to duty.

Sgt. C. E. CURNO, R.N.Z.A.F., No. 108 Sqn.—This airman has carried out a total of 34 operations against targets in Germany and Occupied France and in the Middle East. In October, 1941, Sgt. Curno carried out a low-level attack on enemy shipping at Benghazi. He has also participated in low-level attacks on enemy mechanised transport, causing much confusion and damage. He has displayed outstanding determination, coolness and courage and has proved himself to be an inspiration to the rest of the squadron.

Sgt. J. F. DALY, R.A.F.V.R., No. 37 Sqn.—This airman has carried out 36 operational sorties against targets in Germany, Holland, Greece, and in the Middle East. His skill as navigator-bomb aimer is of a high order, and on several occasions he has been largely responsible for the safe return of his aircraft in bad weather. His courage and devotion to duty have set a fine example.

Sgt. H. L. G. DODSON, No. 37 Sqn.—This airman has taken part in operational sorties against objectives in Greece, Crete, Cyrenaica, Syria and the Dodecanese. The high standard of courage and devotion to duty he has maintained as gunnery leader has set a fine example to the rest of his flight.

Sgt. G. E. FORD, No. 216 Sqn.—This airman has served with the squadron since 1927, and is its most experienced pilot. He has carried out 12 successful night bombing raids and evacuated over 100 persons from Crete in his aircraft. This airman has displayed great qualities of leadership.

Sgt. G. B. FORREST, No. 272 Sqn.—This airman is a flight commander's observer and has taken part in many operations over the Mediterranean. On two occasions he has enabled his pilot to regain control of a badly damaged aircraft and bring it safely back to base. On one of these occasions he held the control column of the aircraft for two hours when three feet had been knocked off one of the wings. Sgt. Forrest has shown consistent courage in the face of the enemy and has displayed great devotion to duty.

Sgt. E. D. FOWLER, No. 37 Sqn.—As a wireless operator-air gunner this airman has carried out many long-distance operations against the enemy, including attacks on objectives in Greece, Cyrenaica, Tripolitania and the Dodecanese. On one occasion his aircraft was forced down on the sea by engine failure and he spent 15 hours in a dinghy before being rescued. Sgt. Fowler continues to display the utmost keenness and enthusiasm and sets a fine example to all.

Sgt. G. E. C. GENDERS, R.A.F.V.R., No. 33 Sqn.—This airman has taken part in operations over Greece, Crete and the Western Desert with great courage and determination. In the course of these operations he has destroyed at least seven enemy aircraft and damaged several others. He has set the junior pilots of the squadron an excellent example.

Sgt. M. S. HARDS, R.A.F.V.R., No. 250 Sqn.—This airman has displayed great skill as a fighter pilot during operations in the Western Desert, in which he has been twice wounded. In December, 1941, whilst on patrol with three other aircraft, he observed a force of 24 enemy bombers escorted by ten fighters.

Despite the superior number of fighters, the section attacked the bombers, and Sgt. Hards destroyed one of them; he also destroyed a fighter. On a previous occasion when his squadron was acting as escort to a force of bombers, the formation was attacked by some 15 Messerschmitt 110's. During the engagement several enemy aircraft were shot down, one of which Sgt. Hards destroyed besides damaging a further two. This airman has destroyed at least seven enemy aircraft.

Sgt. L. O. HARRISON, No. 107 Sqn.—As an air gunner, this airman has taken part in 38 operational flights from Malta. One day in November, 1941, he bombed and set on fire a 4,000-ton enemy merchant vessel. Sgt. Harrison has also scored hits on enemy factories, military barracks and motor transport columns. He is an exceptionally keen and competent air gunner, and his initiative, keenness and courage have set an excellent example.

Sgt. (now W/O.) B. D. B. LEWIS, No. 216 Sqn.—In the autumn of 1941, this airman was captain of a formation of three aircraft detailed to carry important personnel from advanced air headquarters to Tobruk, when the latter was still completely surrounded by German forces. When Sgt. Lewis arrived in the vicinity of Tobruk, a German bombing raid was taking place and the whole of the defences were firing. With great determination, this airman flew through the defences and made a successful landing. The Germans saw the flare path light up and attempted to destroy the aircraft on the ground. To save his aircraft, Sgt. Lewis took off again and landed safely at his base in daylight.

Sgt. R. C. LOCKHART, R.A.A.F., No. 37 Sqn.—As a wireless operator, this airman has partici-

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pated in attacks on objectives in Occupied France, Greece, Syria and Cyrenaica. His skill as a wireless operator, together with his keenness and initiative, have gained him the entire confidence of the rest of the crew and have set a splendid example.

Sgt. R. D. MILLAR, No. 84 Sqn.—This airman has carried out 74 operational sorties against the enemy over Europe and the Western Desert. Sgt. Millar is considered to be the best observer in the squadron. He is a splendid navigator and bomb aimer.

Sgt. J. H. MOSSLEY, R.A.F.V.R., No. 108 Sqn.—This airman has carried out a total of 38 raids against the enemy (26 were as captain of aircraft). 27 of these sorties were carried out from England against targets in Germany. One night in October, 1941, Sgt. Mossley was detailed to carry out an attack on buildings and storehouses on the north side of Berka airfield. He carried out the attack from a height of 400 feet and made three separate runs over the objective. All his bombs hit the target, starting large fires. Sgt. Mossley then machine-gunned searchlights and anti-aircraft gun positions. On another occasion he was attacked by enemy fighters on the way to the target, but, by skilful evasive action, he succeeded in beating them off and, although his aircraft was damaged, he flew on and successfully bombed his target. This airman has displayed exceptional keenness for operations and has proved himself to be an inspiration to all.

Roll of Honour

Casualty Communique No. 126.

THE Air Ministry regret to announce the following casualties on various dates. The next-of-kin have been informed. Casualties reported "in action" are due to flying operations against the enemy; "on active service" include ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths

Royal Air Force

KILLED IN ACTION.—F/O. B. O. Fryer; Sgt. W. R. Gregory; Sgt. K. B. Harvey; Act. Flt. Lt. J. E. Hegg; P/O. J. D. N. Lister; F/O. R. W. P. Mackenzie; F/O. T. Nicholson.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. J. F. Ashton; Sgt. E. R. Backhouse; Sgt. M. E. G. Hastings; Sgt. E. R. V. Lane; Sgt. G. Maher; F/O. J. P. Middlehurst; Sgt. W. H. Poole; P/O. A. J. Pyle; P/O. H. G. Reynolds; Sgt. A. W. Smith; Sgt. H. T. Smith.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. J. N. Alder; Sgt. E. R. Amos; Sgt. E. Ashworth; Sqn. Ldr. J. C. Atkins; Sgt. J. Bainbridge; Flt. Sgt. R. A. Bates; Flt. Lt. W. B. Baxter; Sgt. A. Beacham; Sgt. C. P. Blackburn; P/O. P. Brown; Sgt. L. R. Burrows; Sgt. G. C. Caesar; P/O. J. L. Calvert; Flt. Sgt. J. T. Carmichael; Sgt. R. T. Clark; P/O. E. R. P. S. Cooper; Sgt. J. J. Cox; Sgt. T. Craven; Sgt. J. M. R. Cruickshank; Flt. Sgt. A. D. W. Curr, D.F.M.; Sgt. J. H. H. Cutmore; Sgt. G. G. Duckers; Sgt. W. T. Ellis, D.F.M.; Sgt. A. W. Evans; P/O. J. E. Evans; Sgt. J. A. Fawkes; Sgt. W. R. Fisher; Sgt. E. Fox; Flt. Sgt. S. D. Gallery; P/O. C. C. O. George; P/O J. D. Gould; Sgt. A. G. Greenlees; P/O. E. S. Hale; Sgt. R. Haley; Sgt. P. A. Hammond; Flt. Sgt. M. C. Harvey; Flt. Sgt. A. J. Heller, D.F.M.; Sgt. D. F. Henderson; Flt. Sgt. R. F. Hind; Sgt. G. P. Imison; Sgt. K. A. King; Sqn. Ldr. R. A. L. Knight, D.F.C.; Sgt A. J. Le Poidevin; Sgt. B. Lloyd Jones; Sgt. G. S. Lodington; Flt. Sgt. G. P. Mansel; Sgt. H. B. McKenzie; Sgt. A. D. L. Mitchell; Sgt. A. W. Morgan; Sgt. R. Morgan; Sgt. C. H. Naylor; Sgt. J. A. Nichols; Sgt. A. E. Owen; Sgt. J. Porthouse; Sgt. E. N. R. Robertson; P/O. B. B. H. Rodwell; Flt. Sgt. E. F. Reeve; Sgt. J. G. Richardson; P/O. P. Shelley; Sgt. E. Short; P/O. G. A. Skelly; P/O. C. MacK. Stickney; Sgt. P. Stocks; Sgt. E. D. Suggett; Sgt. C. Tatton; Sgt. R. M. Thomas; P/O. R. V. Trueman; Flt. Sgt. R. L. Viner; Sgt. F. G. Walker; Sgt. R. Willis; Sgt. P. Wilson; Sgt. E. Wood; Flt. Sgt. H. K. V. Wyatt; Sgt. M. A. Young.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—P/O. T. R. Ruxton; F/O. J. E. Sulman.

WOUNDED OR INJURED IN ACTION.—P/O. W. J. Locke; Sgt. E. J. Sparks.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. E. I. Nightingale

MISSING, BELIEVED KILLED IN ACTION.—P/O. E. A. Bairstow; Sgt. J. Bradbury; Sgt. P. R. Cooper; Sgt. F. Coulson; P/O. M. W. T. Kidson; Flt. Sgt. A. L. Narracott; P/O. J. D. Tew; Act. Flt. Lt. E. J. Watson.

MISSING.—Sgt. J. E. Andrews; Sgt. E. Anstee; Sgt. R. F. Barker; Act. Flt. Lt. L. A. Brain, D.F.C.; Flt. Sgt. R. H. Brown; P/O. H. B. Carleton; P/O. H. Cookson; Sgt. T. Crump; Sgt. R. V. P. Ennor; Sgt. G. E. Fox; Flt. Sgt. R. O. George; Sgt. C. Grimwood; Flt. Sgt. G. C. W. Gutersohn; Sgt. C. W. Harvey; Flt. Sgt. E. E. Hett; P/O. M. S. Job; P/O. R. A. C. Johnson; Sgt. T. L. Kennea; Act. Sqn. Ldr. F. P. J. McGevor, D.F.M.; Wing Cdr. N. G. Mulholland, D.F.C.; Sgt. T. Pierpoint; Sgt. G. Poole; Flt. Sgt. J. Robertson; P/O. J. S. Robinson; Sgt. R. Robinson; Sgt. W. Templeton; Sgt. E. Thorpe; P/O. E. Tunnington; Sgt. F. J. Wakefield; P/O. R. G. Walder; Act. P/O. J. W. Willis-Richards.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—F/O. H. A. Tyrrell.

KILLED ON ACTIVE SERVICE.—Sgt. J. W. Avis; P/O. D. A. Cook; Sgt. D. G. Hutchinson; P/O. C. E. Lees; L.A/C. H. Lees; P/O. G. R. Oatley; Act. Flt. Lt. J. H. Pickering; P/O. J. M. Pope; Sgt. C. G. Ridgewell; P/O. G. R. Scott; L.A/C. J. McD. McL. Smith; Act. Sgt. R. A. Wright.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. C. W. Bonser; Sgt. A. H. Geils; Sgt. R. E. Jones; Flt. Sgt. G. Prout; Sgt. W. J. Spicer.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. E. Colton; A/C.1 T. H. Foley; A/C.2 J. S. Glazier.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—P/O. D. J. Browne; L.A/C. J. W. G. Johnson; L.A/C. A. D. Robinson; L.A/C. A. J. Skinner; L.A/C. M. G. Steed.

DIED ON ACTIVE SERVICE.—A/C.2 R. S. Allen; L.A/C. S. A. Bacon; A/C.2 D. V. Bunn; A/C.2 H. Butcher; L.A/C. G. Butt; A/C.2 L. Dent; A/C.2 J. G. Frost; L.A/C. J. Graham; Act. Wing Cdr. W. R. Hellard; Wing Cdr. L. V. Hirst; Sgt. H. Kirk; A/C.2 J. R. Lambert; A/C.2 R. H. Lucas; L.A/C. A. D. Murray; Sgt. K. T. Naylor; Cpl. J. Prince; Sgt. K. G. Proctor; L.A/C. C. W. Redfearn; A/C.1 C. Robinson; L.A/C. W. Smathers; L.A/C. S. J. Smith; A/C.2 J. Sneddon; L.A/C. A. Southern; A/C.2 C. P. Thompson; A/C.1 K. M. Townsend; Sgt. J. Whittaker.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. J. Alves; Sgt. R. Ballantyne.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/CW.2 E. Cummings; A/CW.2 D. Davies; A/CW.2 P. M. Duffield.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. J. H. Goodey; Act. F/O. R. C. Scarlett.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. C. G. B. Chapman; Sgt. R. G. Gazzard; Sgt. M. R. Ross.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW REPORTED KILLED IN ACTION.—P/O. H. McG. M. Patterson.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Flt. Lt. J. H. Saunders.

WOUNDED OR INJURED IN ACTION.—P/O. G. R. Anderson.

MISSING, BELIEVED KILLED IN ACTION.—P/O. B. A. Willis.

Danish pilots of a fighter squadron which has a flight of Spitfires subscribed for by the Danish Fighter Fund.

MISSING.—Sgt. R. H. Clark; Sgt. E. Gray; Sgt. G. S. Long-Innes; Sgt. A. C. Lowe; Sgt. H. McCrachaen; F/O. C. K. J. Thompson; Sgt. A. E. Wills

KILLED ON ACTIVE SERVICE.—Sgt. C. B. Macaskell.

WOUNDED OR INJURED ON ACTIVE SERVICE.—P/O. J. G. Gorton; P/O. W. N. McCulloch; Sgt. G. W. Schaffer.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. R. V. Harvey.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. H. McL. Aitchison; Sgt. R. W. Gardner.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. R. G. F. Alderley; Flt. Sgt. J. M. Boyd; P/O. R. M. Burlinson; Sgt. J. C. Crump; Sgt. H. E. Robinson; Sgt. J. H. Stoll.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. N. S. Hall.

MISSING.—Sgt. G. F. Clarke; Sgt. R. S. Daniel; Flt Sgt. G. R Foster; Flt. Sgt. A. Moran; Sgt. W. J. Oxendale.

KILLED ON ACTIVE SERVICE.—Sgt. M. M. Harley; P/O. G. F. Keele; P/O. R. E. Manders; Sgt. J. W. Yost.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. E. M. Brennan; Sgt. E. D. Simon; P/O. F. D. Simpkins; P/O. E. L. Simpson.

DIED ON ACTIVE SERVICE.—Cpl. P. J. Turgeon.

Royal New Zealand Air Force

KILLED IN ACTION.—Sgt. A. H. R. Hawkins.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. T. R. Murphy; Sgt. J. A. Ward, V.C.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. D. A. Dacre; Sgt. M. J. Fraser; Sgt. G. D. Osborne; Sgt. J. T. Wallace.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. C. M. Gray

MISSING.—P/O. S. W. Reid; Sgt. J. N. Vincent.

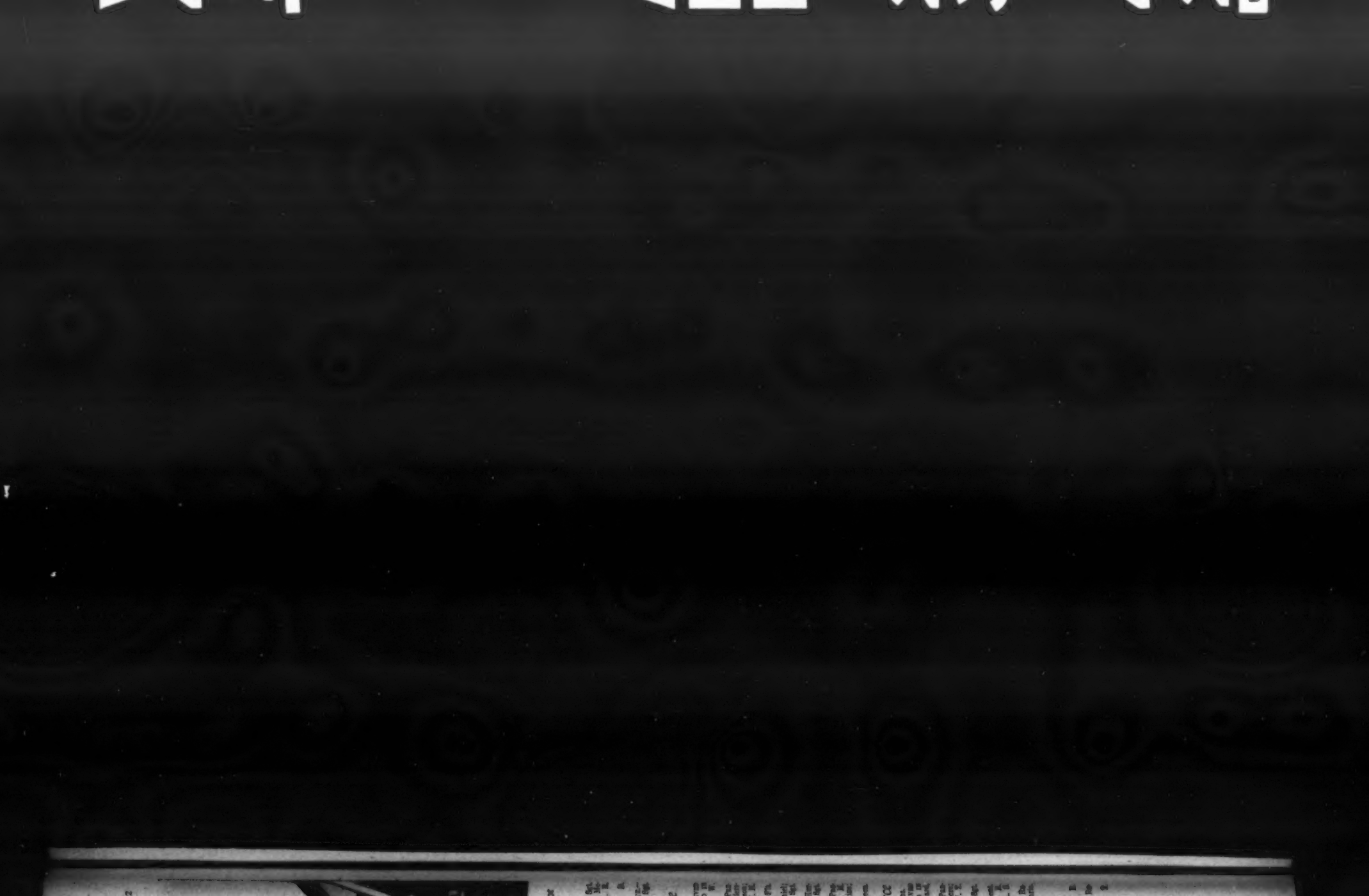
KILLED ON ACTIVE SERVICE.—Sgt. L. G. E. Donaldson; P/O. J. J. J. Grevatt; P/O. R. A. T. Parker; Sgt. B. S. Wilder.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—P/O. G. E. Guthrie.

South African Air Force

KILLED IN ACTION.—Lt. T. J. P. Botha.

KILLED ON ACTIVE SERVICE.—A/C. J. B. Chapman.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Lt. G. Reilly.

DIED ON ACTIVE SERVICE.—Air Mech. A. T. Young; Air Sgt. J. B. Jardine.